Planning Division
Environmental Branch

Mr. James J. Slack
U. S. Fish and Wildlife Service
1339 20th Street
Vero Beach, Florida 32960-3559

Dear Mr. Slack:

Thank you for the Draft Fish and Wildlife Coordination Act Report (CAR) of July 24, 2002, and amended on Jan 14, 2003 for the Port of Miami Navigation Project in Dade County, Florida. A detailed reply to the 17 recommendations in the CAR is enclosed. We intend to comply with some of the recommendations in the draft CAR (2,3,4,7,9,10,11,12,13 & 17). The remaining recommendations are not under our jurisdiction or are economically infeasible to implement.

If you have any questions, please contact Terri Jordan at 904 232-1817.

Sincerely,

James C. Duck
Chief, Planning Division

Enclosure
Cc: Port of Miami – Becky Hope

Jordan/CESAJ-PD-EA/1817/
McAdams/CESAJ-PD-EA
Mason/CESAJ-PD-E
Perez/CESAJ-DP-C
Strain/CESAJ-PD-P
Duck/CESAJ-PD

Recommendations in CAR
Port of Miami GRR Navigation Project
Detailed Reply

(1) Develop a monitoring plan and survey methodology to determine the extent of the direct and/or indirect effects of sand placement, groin construction, and/or borrow site dredging on seagrass and/or hardbottom. A mitigation plan will be needed, if resources are adversely impacted. Prior to the initiation of the monitoring plan and/or surveys, copies should be submitted to the Service for review. Jan 14, 2003 addendum – This recommendation addressed monitoring; however, we would like to clarify that the monitoring plan should encompass channel walls and previously dredged channel bottom, if it is to be an element of mitigation should be instituted during dredging regardless of the water column exemption for turbidity monitoring within the stated 150 foot mixing zone.

<u>Response to recommendation</u> – The Corps will abide by the monitoring requirements of the FLDEP Water Quality Certificate, when issued and accepted. Recommendation #1 appears contradict recommendation #2 with regard to monitoring.

(2) The Service should be provided with final details for disposal methods, land-use history and current habitat data for areas adjacent to the upland disposal site on Virginia Key and resource information for areas surrounding seagrass mitigation sites (which will receive some spoil material). If necessary, Service staff may visit the sites to ensure that there are no anticipated adverse impacts to jurisdictional wetlands, surface waters, or protected species. If the upland site is judged adequate for disposal based on lack of effects to fish and wildlife, the Service recommends that discarded materials be contained in a diked area and that Best Management Practices are followed in order to prevent erosion and runoff following storm events and dewatering. Plans should include turbidity containment devices at the dewatering outfall.

The Service requests participation in the development of a water quality monitoring program to determine if turbidity levels (and contaminant levels, if relevant) may be adversely affecting fish and wildlife resources and/or habitats in or adjacent to the project area. The Service recommends water quality monitoring to occur at regular intervals, particularly in reef and seagrass communities, during dredging activities to ensure compliance with State of Florida water quality requirements. In addition, the Service requests copies of all water quality data resulting from sampling activities both during and after dredge operations. Finally, a contingency plan to halt operations must be in place should suspended sediment concentrations exceed acceptable levels. A 150-meter allowable mixing zone near the cutterhead would be exempt from data collection for monitoring purposes.

A monitoring plan to monitor channel-wall hardbottom habitat should be submitted to FWS/NMFS, and all data/reports pertaining to recovery of coral and sponge communities on channel walls must be submitted to the Vero Beach FWS office and the Miami NMFS office. Schedule for submittal, monitoring parameters and methods, will correspond with artificial reef monitoring.

Response to Recommendation – If the upland disposal site will be used for material disposal, details of that disposal site can be provided to the Service if it is determined that any resources under the Services jurisdiction will be impacted. When a detailed mitigation plan is completed, this will be submitted to the resource agencies, including the Service, for review – this report will include details of the selected mitigation sites.

(3) Implement an effective watch program during blasting that is designed to delay detonation until the designated safety zone is clear of marine mammals and/or sea turtles to minimize possible adverse effects to listed species during blasting activities, as described in the following section. The most effective watch program consists of the primary survey observer based in an aircraft with secondary observers on boats, bridges, and/or land with sufficient communication among all observers and the demolition contractor.

Response to Recommendation - As stated in the Corps' DEIS and Biological Assessment under the ESA submitted to the FWS, the Corps will instigate an effective watch program to be initiated during blasting activities during port construction that will include a safety zone to ensure protection of listed and protected species in the action area.

(4) During the coordination meetings, troubleshoot for potential problems such as radio contact failure among observers and/or the blasting subcontractor, poor weather or visibility issues, etc., and develop a contingency plan to resolve the issues.

Response to Recommendation - A coordination meeting will be held between the parties involved in the construction and observers to address these potential issues.

(5) Remove and relocate all brain and star coral within the 2.7 acre of high-relief coral reef impact area related to Component 1 by authorized and experienced personnel to appropriate areas within the vicinity of the original location and include monitoring provisions. Amended recommendation (Jan 14, 2003) – Remove and relocate all hard coral colonies larger than 6 inches in diameter within the project footprint (including the previously dredged areas) by experienced personnel through established methods to suitable nearby hardbottom substrate. Biological monitoring should be instituted.

Response to Recommendation - To accept this recommendation, the Corps must conduct a survey and map corals greater than 6 inches throughout more than 49 acres of hardbottom communities throughout the project area. Forty-six acres of this is previously dredged, and will recover, as demonstrated by the recovery of the community since the dredging completed in the early 1990s. Then the Corps must obtain a permit to relocate the corals, or coordinate with Miami- Dade DERM to determine if they have a permit to relocate corals that would cover the project area. This recommendation as amended, is not feasible due to the cost of this survey and the relocation activities. The Corps will discuss this recommendation with the non-federal sponsor and will determine if it is feasible to relocate these corals from the 3.1 acres of reef that is not previously dredged.

(6) Schedule construction activities (blasting and dredging) outside of the winter season, November through March, when manatees are more dispersed.

Response to Recommendation -
Blasting - The Corps has put in place a manatee and protected species protection plan that prohibits blasting when any of those animals are within a certain radius of the blasting activities. During the winter months, when manatee densities may be higher near the project area, the Corps may not be able to blast as often as during the summer months. The Corps will not blast when manatees, or other protected species, enter the no blast zone.

Dredging - After years of construction activities taking place near manatee habitats, neither the Corps nor the Service has any documented adverse effects of Corps dredging operations on manatees. The Corps will implement the standard manatee protection techniques drafted in conjunction with the Service to protect manatees during dredging operations.

(7) The Service recommends decreasing the impact area as much as possible by narrowing the channel width as much as is practicable. Likewise, impacts to reefs at the east end of the entrance channel should also be reduced as much as is practicable. January 14, 2003 - Amended – The Service would like to emphasize this recommendation to reduce channel expansion in hardbottom, seagrass, and shallow sandy bottom habitats prior to the consideration of mitigation.

Response to Recommendation - The Corps has minimized the width of the entrance channel as much as vessel safety allows through consultation and vessel simulations with the Port pilots, as well as the Coast Guard. The extension and widening of the entrance channel is necessary for ship safety and maneuverability due to the currents of the Gulf Stream directly offshore of the port. All of the avoidance and reduction in impacts was done early in the project-planning phase, and through this planning process, impacts of the project have been greatly reduced from the initial project design.

(8) Second, due to the fact that larger, less maneuverable ships will be utilizing the harbor, there may be an increased need for use of tugboats to position vessels. Therefore, the Service recommends that tugs be required to have kort nozzles or ducted propellers, and that operators are sure that no manatees are behind tugs when backing.

Response to Recommendation - The Corps has no jurisdictional authority to implement this recommendation.

(9) Minimize possible adverse effects to nesting sea turtles and hatchlings by reducing or redirecting the lighting on offshore equipment and/or vessels.

Response to Recommendation - The Corps has addressed this concern in the DEIS as well as in consultation with the National Marine Fisheries Service under the ESA. The following language was included in the Biological Assessment sent to NMFS for this project:

> Disorientation due to lighting - One possible element of the action that may indirectly affect sea turtles is the presence of light and/or noise from construction/dredging vessels anchored offshore. These factors may interrupt the

movement of adult, nesting, female turtles swimming toward or away from nesting beaches, and may cause disorientation of hatchlings following emergence. However, since the port is an active facility, offshore lighting is not an unusual feature of the area, and should not appreciably change the ambient conditions of nesting areas in the vicinity of the action. In addition, all construction/dredging vessels are required to adhere to best management practices, such as preventing lights from exposure to shore through use of shields, as required by NMFS in its 1997 Biological Opinion (NMFS, 1997) and adopted by the Corps in its standard specifications for working in areas where sea turtles may be present. Therefore, no adverse indirect impacts due to dredging operations are anticipated for the proposed action.

The Corps is currently awaiting a Biological Opinion from NMFS for this project.

(10) Any incident involving the death or injury of listed species should be immediately reported to the Service (Vero Beach), National Marine Fisheries Service (St. Petersburg office), and the Corps (Jacksonville District).

Response to Recommendation - The Corps or our contractors will immediately report the death or injury of any protected species to the FWS, NMFS, and FFWCC.

(11) Best Management Practices (BMPs) should be implemented to prevent excessive siltation during hopper barge loading (if such a vehicle is used). Proper maintenance of dredging equipment, the use of silt curtains or gunderbooms, performing operations when protected species are not present, and dredging only when environmental conditions are not contributory to siltation/sediment transport would minimize the impacts to fish and wildlife resources. It is recommended that certain protocols be followed, depending on the method used for dredging. If a hopper dredge is used, operators are recommended to eliminate or reduce hopper overflow, lower hopper fill-level, and use a re-circulation system. If a mechanical dredge is used, operators should increase cycle time and eliminate both multiple bites and bottom stockpiling. For operations where a hydraulic dredge is used, cutterhead rotation speed and swing speed should be reduced, and bank undercutting should be eliminated. When applicable, special equipment, such as pneuma pumps, closed buckets, large capacity dredges, and precision dredging tools and technologies, are recommended to further decrease the potential for adverse effects to marine communities (Corps 2001a).

Care should be taken during dredging efforts to limit the amount of fine sediment re-suspended to assure that impacts to adjacent seagrass beds and coral reefs would be minimized. If possible, turbidity containment devices should be installed.

Response to Recommendation - Best Management Practices will be used during the construction of the Miami Harbor Navigation Project.

(12) Due to the level of fine-grained material present in the benthic sediments of Biscayne Bay, this material should not be used for beach renourishment activities; instead it should be used as substrate at the seagrass restoration site.

Response to Recommendation - None of the material that will be dredged from the Miami Harbor Project will be placed on Miami beaches.

(13) Biological monitoring should be conducted during a test blast in order to assess damage to populations of managed and protected fish species, and hence assess whether blasting impacts exceed acceptable levels. If results indicate that blasting has only minimal impacts on populations, and other Service recommendations are followed, blasting may be used where absolutely necessary. However, further monitoring would be required during project blasting. After each blast during project implementation, it is recommended that the effects of blasting on EFH and managed species, and species protected under ESA or MMPA is determined. This plan should be coordinated and approved by FWS and NMFS, and should ensure that no incidental take of manatees, sea turtles or sawfish occurs during construction (dredging, blasting, and hopper barge transport), and that harassment as defined by MMPA is avoided. Use of hydrophones and other technologies to determine likely impacts are encouraged.

Response to Recommendation - The Corps will be conducting blasting in the Miami Harbor, Dodge-Lummus Island turning basin in the near future as part of the completion of the phase II project. The Service was involved in coordination on this activity, including conducting a Section 7 Consultation dated June 19, 2002, that resulted in a concurrence with the Corps' determination of not likely to adversely impact the endangered manatee. We plan to monitor the effects of this deepening as a test blast for the Miami Harbor Navigation project. Additionally, during construction of the Miami Harbor Navigation Project, the effects of each blasting event will be recorded by onsite observers to determine the effects of the action on protected and managed species in the area. The current monitoring plan, as approved by the Service in its Section 7 Consultation dated July 24, 2002, ensures that no incidental take of crocodiles or manatees will occur. The Corps is currently awaiting a Biological Opinion from NMFS concerning potential impacts of the project on listed species under their jurisdiction, and NMFS will make a determination concerning incidental take of those same species; however, the Corps does not expect any incidental take to occur as a result of our current blasting program.

(14) Continue bi-annual monitoring of mitigation areas for a minimum of 10 years to ensure acreage is maintained and remediate, if required.

Response to Recommendation - The Corps or the non-federal project sponsor will abide by the monitoring requirements of the Florida Department of Environmental Quality Water Quality Certificate, when issued and accepted.

(15) A minimum of 19.3 acres of in-kind mitigation should be provided should be provided for hardbottom impacts to newly and previously dredged hardbottom habitat. This should be included in the hardbottom-monitoring plan.

Response to Recommendation - The Corps and its non-federal sponsor will provide sufficient mitigation for the impacts associated with the project. However, the Corps does not accept this recommendation for additional mitigation as requested by the Service. The area that will be dredged has been previously dredged and has recovered since that dredging event, as noted by both the Corps and the Service. Additionally, the Port of Miami mitigated for the impacts of the dredging of those hardbottoms during the 1990 dredging event. At this time the Corps has no plans to offer mitigation for the previously dredged and mitigated hardbottoms as requested by the Service.

Upon reviewing the mitigation recommendations of the January 14, 2003 letter, we have discovered an inconsistency between the proposed impacts stated in the Draft EIS and those stated in the Draft CAR. Please see the table below, specifically the value for low relief hardbottom/reefs that have been previously dredged and recolonized.

Habitat Type and Dredge Status	DEIS value	CAR value
Low relief hardbottom/reef – not previously dredged	0.6	0.6
Low relief hardbottom/reef – previously dredged	28.1	30.7
High relief hardbottom/reef – not previously dredged	2.7	2.7
High relief hardbottom/reef – previously dredged	18.0	18.0

This inconsistency has caused an over estimation of the impacts associated with the proposed project, which also means that FWS over estimated the recommended mitigation associated with the project. We request that FWS revise its impact values for the final CAR.

(16) In-kind mitigation should be provided from dredging 23.3 acres of shallow sandy softbottom habitat, at a ratio of 1:1, such as filling or partially filling existing dredge holes and/or abandoned channels in nearby waters.

Response to Recommendation – Compared to the seagrasses and hardbottom reef communities being impacted by this project, the Corps considers shallow, sandy softbottom to be a lower value habitat type. This habit is not considered EFH by NMFS and as a result the Corps rejects this recommendation for the requested mitigation.

(17) In addition, the Service strongly recommends inclusion of the following in the project design, to further minimize and reduce potential adverse effects of blasting on listed species, as excerpted from the FWC's Endangered Species Conservation Conditions for Blasting Activities dated June 2001.

Response to Recommendation - The Corps will incorporate into our plans and specifications as many of the Conservation Conditions for Blasting Activities as are feasible and practicable.

Additionally, the Corps noted that no recommendation concerning seagrass mitigation was included in the Services recommendation section of the CAR, however, Section 7.1.1, found under section 7.1 "Evaluation of Mitigation" states the following:

> "The Service recommends that for each acre of seagrasses that is anticipated to be impacted as a result of widening Fishermen's Channel and the Fisher Island Turning Basin, three acres be created or restored (3:1 ratio). This includes the impacts during dredging (0.34 acre), as well as the impacts to 6.0 acres adjacent seagrass beds during equilibration of the side-slope ("sloughing"), which is reasonably certain to occur. Therefore, restoration of 18.9 acres of seagrass would compensate for the 6.3 acres of seagrass impacted during the construction of Components 3 and 5. However, monitoring must be conducted to ensure recruitment of seagrasses at the mitigation site. If acceptable coverage of seagrasses is not achieved within three years, another mitigation site must be constructed, or installation of plants must occur at the site. Survival and coverage standards must be achieved in either case."

If this is the Service's position and recommendation, the Corps rejects the mitigation ratio for the following reasons. The Corps and the project sponsor believe that this restoration project will demonstrate the same recovery pattern as seen by other seagrass restoration projects in Biscayne Bay. Examples of these sites are included as a reference. The Corps believes that due to the likelihood of success of the proposed seagrass mitigation, a 1:1 ratio is acceptable for the impacts of the proposed construction. Although we reject the mitigation ratio, we accept the Services request that monitoring of the site for three years post-filling be conducted and that if the site does not naturally recruit, then supplemental planting be performed to speed recovery. Planting methods will be developed following guidance by Fonseca et al. (1998) and peer review by NMFS. Detailed plans and specifications for the seagrass creation will be prepared and provided for agency concurrence prior to construction.

Seagrass recovery examples

Restoration of a three-acre borrow area in North Biscayne Bay was completed in the late 1990's by Miami-Dade Environmental Resources Management (DERM) and recently inspected by NMFS, FWS, and DERM staff during an agency site visit with the USACE's contractor in March of 2002. Although no monitoring has been done by DERM since planting of the site, a visual inspection by the agency team revealed that seagrass occurs throughout the site and was dominated by *H. wrightii* and *T. testudinum*. Discussions with DERM staff indicate the old borrow area was filled with rubble and sand and planting units of both *H. wrightii* and *T. testudinum* installed. Based on this evidence of general success, all in attendance agreed that seagrass restoration was a viable option for mitigating seagrass loss.

Another example of successful seagrass restoration is the Miami-Dade sewage cross-bay force main installed by the Miami-Dade Water and Sewer Authority Department in the mid-1990s. The project required trenching of over one mile of Miami Harbor baybottom for pipeline installation, including excavation of 1.80 acres of seagrass beds. Once the pipeline was installed the 22-foot wide trench path was refilled and allowed to recruit with seagrasses. Recruitment had begun within one-year and after two years seagrasses and macroalgaes covered the trench pathway so that it was no longer visible on aerial photography.

June 17, 2003

Colonel James G. May
District Engineer
U.S. Army Corps of Engineers
701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

Service Log No.: 4-1-03-I-786
Project: Miami Harbor General Reevaluation Report and Draft Environmental Impact Statement
Sponsor: Port of Miami
County: Miami-Dade

Dear Colonel May:

In accordance with the Fiscal Year 2001 Transfer Fund Agreement between the Fish and Wildlife Service (Service) and the U.S. Army Corps of Engineers, enclosed is the Final Fish and Wildlife Coordination Act (FWCA) Report regarding the Miami Harbor Expansion Project, Miami-Dade County, Florida. This final report, provided in accordance with the FWCA of 1958, as amended (48 Stat.401; 16 U.S.C. 661 *et seq*.) and under the provisions of section 7 of the Endangered Species Act of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 *et seq.*), has been prepared to provide an evaluation of environmental effects of the navigation improvements to Miami Harbor. This report constitutes the final report of the Secretary of the Interior as required by Section 2(b) of the FWCA.

Thank you for your cooperation and effort in protecting fish and wildlife resources. Should you have any questions regarding the findings and recommendations contained in this report, please contact Trish Adams at 772-562-3909, extension 232.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

Enclosure

cc:
FWC, Vero Beach, Florida
FWC, West Palm Beach, Florida (Ricardo Zambrano)
FWC, Bureau of Protected Species Management, Tallahassee, Florida (Carol Knox)
NMFS, Habitat Conservation Division, Miami, Florida (Jocelyn Karazsia)
NMFS, Protected Species Division, St. Petersburg, Florida (Eric Hark)
Sierra Club, Miami Group, Miami, Florida (Kent Robbins)

C:\Project Files\Miami GRR\EIS\Appendix K - FWS CAR\Miami Harbor Cvr Final CAR.wpd

Miami Harbor Expansion Project
Fish and Wildlife Coordination Act Report

FINAL

Prepared for
Fish and Wildlife Service
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

by
Dial Cordy and Associates Incorporated
490 Osceola Avenue
Jacksonville Beach, Florida 32250

June 17, 2003

EXECUTIVE SUMMARY

The Seaport Department of Miami-Dade County requested that the U.S. Army Corps of Engineers (Corps), study the feasibility of modifying portions of Miami Harbor to improve the Federal navigation system of channels. This Fish and Wildlife Coordination Act (FWCA) Report evaluates the likely effects of the proposed harbor expansion project on fish and wildlife resources and is submitted in accordance with provisions of the FWCA of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 *et seq*.) and the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 *et seq*.).

The Port of Miami (Port) located in Miami-Dade County, Florida is one of the major port complexes along the east coast of the United States. The Port utilizes Miami Harbor, which lies in the north side of Biscayne Bay, a shallow, expansive, subtropical estuary. The mainland and islands surrounding the Port of Miami are fully developed, except for Virginia Key. Terrestrial and marine habitats in the vicinity of the project area include the coastal strand, mangroves, seagrass beds, coral reefs and other hardbottom, sand/silt-bottom habitats, and rock/rubble-bottom habitats. Miami Harbor is located in the Biscayne Bay Aquatic Preserve and is adjacent to the Bill Sadowski Critical Wildlife Area (CWA), a "No Entry" zone for protection of the West Indian manatee and wading birds associated with Virginia Key. In addition, the project lies within the boundaries of designated Critical Habitat for the West Indian manatee (*Trichecus manatus*) and Johnson's seagrass (*Halophila johnsonii*).

The proposed navigational improvements to Miami Harbor will impact habitats utilized by fish and wildlife populations. Modifications to the Federal system of channels under the Recommended Plan include: (1) deepening the entrance channel through Government Cut and Fishermen's channel in Miami Harbor; (2) relocating channel makers within the main channel, which does not include dredging; (3) widening the east end of the entrance channel; (4) widening the intersection of the main and fishermen's channels at the northeast side of Fisher Island; (5) creating a turning basin just east of Lummus Island; (6) widening Fisherman's Channel by traditional dredging methods and/or the use of explosives inshore and offshore. Unconsolidated and consolidated material generated during dredging will be deposited within either approved offshore and upland disposal sites or used during the construction of mitigation areas associated with the proposed project.

The Corps estimates that 6.3 acres of seagrass, 28.7 acres of low-relief hardbottom, 20.7 acres of high-relief coral reef, 123.5 acres of rock/rubble, and 236.4 acres of unconsolidated/unvegetated benthic habitat will likely be adversely affected as a result of the expansion of Miami Harbor. However, many of these habitats occur in areas that were impacted during previous dredging activities within Miami Harbor. Therefore, the total impact to habitats not previously dredged include: 6.3 acres of seagrass, 0.6 acre of low-relief hardbottom, 2.7 acres of high-relief coral reef, 3 acres of rock/rubble, and 23.3 acres of unconsolidated/unvegetated benthic habitat.

As compensation for the impacts to habitat that was not dredged previously, the Corps has proposed the following: (1) mitigate for the removal of 6.3 acres of seagrass at a ratio of 1:1 through the restoration of a 18.6-acre historic dredged borrow site in northern Biscayne Bay where the restored acres provided in excess of the 1:1 mitigation ratio would serve as a compensation "bank" for seagrass impacts associated with future Port projects; (2) mitigate for the removal of 2.7 acres of high-relief coral reef habitat at a ratio of 2:1 through the creation of 5.3 acres of high-complexity, high-relief artificial reef habitat; and (3) mitigate for the 0.6 acre of impact to low-relief hardbottom habitat at a ratio of 1.3:1 through the creation of 0.8 acre of low-complexity, low-relief artificial hardbottom habitat. The Corps has not proposed compensation for the removal of the biotic communities, such as soft corals, sponges, and hard corals, which have colonized within the existing channel walls since the last dredging event in 1991.

The Fish and Wildlife Service (Service) has provided several recommendations in this document to further minimize or avoid possible adverse effects of the harbor expansion project on fish and wildlife resources. Specifically, regarding the permanent removal of 6.3 acres of seagrass and to compensate for the temporal loss of 48.7 acres of hardbottom habitat within the existing channel, the following compensatory mitigation and monitoring is recommended: (1) restore 18.6 acres of seagrass habitat (2.9:1 ratio); (2) develop a Seagrass Monitoring Plan that contains success criteria that is consistent with Fonesca (1998); and (3) create a 15.94-acre mitigation reef to compensate for direct impacts to high- and low-relief hardbottom reef habitat and the temporal loss of function and value associated with the low-relief hardbottom habitat located within the previously dredged channels, particularly the channel walls. In addition, the Service recommends the development of a comprehensive (pre, during, post project) environmental monitoring programs to verify that project impacts occurred within the levels anticipated and to ensure that the mitigation areas are preforming to a level where habitat replacement values are maintained.

The Corps has determinated that the project "may affect, but is not likely to adversely affect" the federally endangered West Indian manatee, endangered American crocodile (*Crocodylus acutus*), endangered green sea turtle (*Chelonia mydas*), threatened loggerhead sea turtle (*Caretta caretta*), endangered Kemp's ridley turtle (*Lepidochelys kempii*), endangered Hawksbill sea turtle (*Eretmochelys imbricata*), endangered leatherback turtle (*Dermochelys coriacea*), threatened Johnson's seagrass, and a species proposed as a candidate for listing (endangered), the smalltooth sawfish (*Pristis pectinata*). In addition, the Corps has determinated that the following whale species may be affected during blasting activities: the endangered humpback whale (*Megaptera novaeangliae*), endangered fin whale (*Balaenoptera physalus*), endangered sei whale (*Balaenoptera borealis*), and endangered sperm whale (*Physeter macrocephalus*) which are known to occur along the Atlantic coast. The Corps has determined that the proposed action "may affect but is not likely to adversely affect" critical habitat that has been designated for the West Indian manatee and the American Crocodile. Since the Corps has agreed to incorporate the *Standard Manatee Protection Construction Conditions* and implement a comprehensive blasting plan to minimize possible adverse effects to listed marine species using the standard "Navy diver" protocol, the Service concurs with the Corps' determination for the two species, which fall under the jurisdiction of the Service, the West Indian manatee and the American crocodile. The Corps has initiated consultation with the National Marine Fisheries Service (NMFS) concerning the remaining listed species.
This report is submitted in accordance with the FWCA and constitutes the final report of the

Secretary of the Interior as required by Section 2(b) of the FWCA.

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APPENDIX E: Tables

1.0 IDENTIFICATION OF PURPOSE, SCOPE, AND AUTHORITY

The Seaport Department of Miami-Dade County requested the Corps to study the feasibility of modifying portions of Miami Harbor to improve the Federal navigation system of channels. This FWCA Report evaluates the possible adverse effects of the proposed harbor expansion project on fish and wildlife resources, including federally listed species and is submitted in accordance with provisions of the FWCA and the ESA.

2.0 PROJECT HISTORY AND SERVICE INVOLVEMENT

The Miami Harbor Project was first authorized by the River and Harbor Act of 1899. Since 1902, several authorized actions such as inlet creation, jetty construction, channel deepening and widening, and maintenance dredging have occurred most notably in 1902, 1912, 1925, 1930, 1935, 1937, 1960, and 1968 (Appendix A). During the 1970s and 1980s, extensive construction occurred as the Port of Miami expanded its facilities on Dodge and Lummus Islands.

Significant commercial shipping activity in the original mainland location of the Port of Miami on Biscayne Boulevard began when a channel was dredged from the mouth of the Miami River east through Biscayne Bay to the Atlantic Ocean in 1896. The dredging of Government Cut in 1903 (which segmented the barrier island and created Fisher Island) and Government Channel in 1916 increased the depth of the port channel. Further deepening took place in 1929 and 1935. By 1946, the old port on Biscayne Boulevard was outgrown, and by 1960, the construction of an entirely new port facility on Dodge Island, an artificial island, in Biscayne Bay began. By the mid-1960's port operations were shifted to Dodge Island. By the 1980's, port operations were further expanded today incorporating Lummus Island, a 225-acre artificial island, into the Dodge Island port operation (Corps 1989). In the late 1980's, plans for further Port expansion were initiated and in June 1989, the Corps Planning Division completed the Feasibility Study Report and Environmental Impact Statement (EIS) (10140) for Navigation Improvements within Miami Harbor. These improvements were authorized by Congress in the 1990 Water Resources Development Act (Public Law 101-640).

However, in the past 12 years, shipping and cruise ship technology has advanced to allow the construction of longer, wider vessels, and deeper-draft vessels, such as the Post-Panamax and Super Post-Panamax. As a result of this shift in the industry standard, the 1990 Miami Harbor expansion proposal was rendered obsolete. A Resolution provided by the Committee on Transportation and Infrastructure of the United States House of Representatives dated October 1997 provided the authorization for the current study to investigate further deepening and widening of channels and turning basins within Miami Harbor to accommodate the changes within the shipping industry. This project includes: the Federal Channel from Buoy #1 offshore, the Government Cut, areas within and adjacent to Miami Harbor from Government Cut to the cruise ship channel turning basin, and Fisherman's Channel to the southwest end of Dodge Island (Figure 1).

Service Involvement

In addition to the Service and the, other Federal agencies involved in the review of the current project included the U.S. Coast Guard, the Environmental Protection Agency (EPA), and the NMFS. State agencies include the Florida Department of Environmental Protection (DEP), State Historical Preservation Officer, and the Florida Department of Transportation. Local agencies include Miami-Dade County Environmental Resources Management (DERM), South Florida Regional Planning Council, and the City of Miami. Non-Government Organizations/Institutions Biscayne Bay Pilots Association and Biscayne Bay Partnership Initiative.

On January 6, 2000, the Corps invited the Service to participate in the plan formulation process regarding the proposed expansion at the Port of Miami and provided information describing the potential dredging activities.

On March 13, 2000, the Service participated in a multi-agency resource meeting to determine the areas of coverage for an environmental baseline resource survey hosted by the Corps.

On November 1, 2000, the Service participated in a follow-up meeting with the resource agencies to review preliminary survey results and discuss additional survey needs.

On January 15, 2001, the Service received the Environmental Baseline Study for the Miami Harbor General Reevaluation Report compiled by Dial Cordy and Associates (DC&A).

On February 19, 2001, the Service and Corps met to designate the scopes of work for the Port of Miami expansion and other Federal projects for the 2001/2002 fiscal year.

On December 2001, the Service participated in a field visit with DC&A, NMFS, and DERM to evaluate the seagrass habitat present within the area to be affected south of Fishermen’s channel. In addition, staff snorkeled a previous seagrass restoration site initiated by DERM in the 1990's to consider the applicability of a similar effort as mitigation for possible seagrass impacts associated with the proposed Port expansion.

On February 19, 2002, the Service participated in a meeting with the Corps, DC&A, NMFS, and DEP to discuss various elements of the project components to identify opportunities to minimize and avoid impacts to fish and wildlife resources, including listed species. In addition, we received the initial preliminary FWCA report for discussion during this meeting.

On March 20, 2002, the Service participated in a multi-agency field investigation of the potential reef and seagrass impact areas associated with Project Components 1, 2, 3, and 5.

On May 24, 2002, the Service received a complete preliminary Draft FWCA report from the contractor for the Service’s review and comment.

On June 20, 2002, the Service attended the Alternatives Formulation Briefing sponsored by the Corps' Jacksonville Office.

On July 24, 2002, the Service provided a complete Draft FWCA to the Corps.

On January 14, 2003, the Service provided a letter to the Corps, which included additional mitigation recommendations regarding the temporal loss of function to low-relief hardbottom habitat located within the existing channels.

On February 2, 2003, the Corps provided a response to the Service's Draft FWCA report and our additional mitigation recommendations described above.

On May 1, 2003, the Corps provided information concerning the 15.1-acre mitigation reef constructed in 1996 as compensation for hardbottom impacts associated with the 1991 Port dredging project.

On May 6, 2003, the Service attended and participated in the public meeting held by the Corps at the Port of Miami to discuss the Draft EIS and General Reevaluation Report for the proposed Miami Harbor expansion project.

3.0 AREA SETTING

3.1 Project Location

The City of Miami is located within Miami-Dade County on the mainland of Florida's southeast coast. The Port of Miami is one of the major port complexes along the east coast of the United States. Dodge/Lummus Island, which comprises the Port of Miami facility, is located within northern Biscayne Bay and lies between the City of Miami to the west and the barrier island of Miami's South Beach to the east. Three islands, Fisher Island, Virginia Key, and Key Biscayne, are located south of the Port and Government Cut. Specific features found to the north of the port's Main Channel include the MacArthur Causeway (Highway A1A), park/recreation and commercial facilities at Watson Island, the Terminal Island industrial area, and the U.S. Coast Guard Base at Causeway Island. Low-density residential uses areas are found beyond the MacArthur Causeway on Palm, Hibiscus and Star Islands. Also, the mouth of the Miami River is located to the west of the Port and can be accessed by two channels adjacent to the Port.

Biscayne Bay is a long, narrow, shallow subtropical estuary that extends from the City of North Miami south to the northern end of Key Largo at the juncture of Miami-Dade and Monroe counties. It is approximately 38 miles long, and ranges from 3 to 9 miles-wide with an average depth of 6 to10 feet (Corps 1989). In addition, Biscayne Bay in its entirety was designated as an Aquatic Preserve in 1980 under Chapter 18-18, F.A.C. and is considered to be State-Owned Submerged Land under the jurisdictional authority of DEP. All aquatic preserves in Florida are designated as Class III, Outstanding Florida Waters (OFW) under Section 62-302.700 of the

Florida Administrative Code. The Biscayne Bay Aquatic Preserve includes all of the waters of Biscayne Bay south to Biscayne National Park. Southern Biscayne Bay is comprised of Biscayne Bay National Park.

In addition to these designations, Biscayne Bay in its entirety, including the waters of Miami Harbor, is designated as critical habitat for the West Indian manatee. The areas designated as critical habitat for the crocodile are located south of the proposed project's boundaries.

Furthermore, 3 areas in the vicinity of the port have been designated by Miami-Dade DERM as special manatee protection areas. Miami-Dade County has identified areas to be designated as essential habitat, such as the seagrass beds located in Dumfoundling Bay and Biscayne Bay between the 79th Street and the Julia Tuttle causeways, between the Port of Miami and Rickenbacker Causeway, in the Chicken Key area and in the area of the Black Creek channel. Additional habitat areas listed for protection under the Miami-Dade County Manatee Protection Plan (1995) include sources of freshwater; warm water refuges (although none currently operate in the boundaries of Miami-Dade County; aggregation areas, which include Sky Lake, the Biscayne Canal near the Miami Shores Country Club golf course, Little River west of Biscayne Boulevard, northwest Virginia Key, upstream Miami River including Palmer Lake, upstream Coral Gables Waterway, and Black Point marina basin as well as manatee travel corridors. In addition, the State-approved Miami-Dade County Manatee Protection Plan places limitations on future construction in two areas near the Port (Curtis and Kimball 1999).

The Bill Sadowski CWA, located adjacent to the Port of Miami (just south of Fisherman's Channel), was established in 1990 by the Florida Fish Wildlife Conservation Commission (FWC). A no-entry zone for the protection of manatees has been created around the Bill Sadowski CWA. Encompassing approximately 700 acres, this area was designated to protect the shallow submerged seagrass and hardbottom habitats, intertidal mudflats and coastal mangrove wetlands in the bay area west of Virginia Key (Figure 4). When first established, the area was protected primarily as a refuge for shorebirds and wading birds, but the boundary was later expanded to include important manatee habitat including calving grounds. This expanded area surrounding the wetland and terrestrial habitats of the CWA has been designated as a "no-entry" zone in order to protect manatees. Buoys demark the no-entry zone, which is closed to boating year-round.

3.2 Description of Project Area

3.2.1 Physical Conditions

Tides, currents, and winds affect environmental conditions in the project area. Tides within the Miami area are semi-diurnal; there are two high and two low tides each day. The mean range at Miami Beach is 2.5 feet (3.0 feet in spring) and the lowest tide is 1.4 feet below mean low water. The Gulf Stream current off the east coast of Florida flows north and varies in velocity from 17 miles per day in November to 37 miles per-day in July. Maximum tidal current velocities through Government Cut are ordinarily about 5.5 feet-per second on an average tide, but occasional velocities of approximately 6.2 feet per-second have been recorded during Spring tide (Corps 1989). From September through February, waves and prevailing winds are predominantly in the northeast and east. During March, April, and May, winds and waves are usually easterly. June through August, winds and waves are in the southeast.

The Biscayne Bay Harbor Pilots have provided comments to the Miami-Dade County Seaport Department describing the navigation challenges and safety concerns regarding the current channel configuration. These challenges would be exacerbated by the increase in ship size and with the addition of the new and larger Gantry cranes that are required to off-load the Super-Post Panamax container ships. The pilots have requested to widen the mouth of the entrance channel (buoy #1), widen the channel in the vicinity of Fisher Island (beacons 13 and 15), and widen Fishermen's channel. The Harbor Pilots have requested these changes based on the following factors: (1) the currents in the vicinity of the entrance channel are variable, unpredictable, and difficult to navigate due to the close proximity of the Gulf Stream current, as evidenced by the groundings of several Maersk container ships at the mouth of the entrance channel (Buoy #1); (2) the area between beacons 13 and 15 immediately south of Government Cut is the intersection ships turn from one channel another. Strong currents in this area, particularly during ebb and flood tides, combined with the required decrease in speed make it important to have as much swinging room as possible for the ship coming into harbor; (3) Currently vessels docked at Lummus Island block a portion of Fishermen's channel during cargo off-loading procedures; thereby, posing a hazard to passing ships. Also, depending on certain conditions (*e.g.*, wind, current, ship size and draft), passing ships may create an unsafe situation where the dock vessels may experience a surge effect as a result of water displacement. This surge has caused a number of mishaps where ships were ripped from their moorings and resulted in damage to the ship, equipment, and cargo. In addition, tankers off-loading fuel at Fisher Island may also experience these effects, posing another hazard. Therefore, to minimize these hazards, the pilots request the widening of Fishermen's channel south of Lummus Island.

3.2.2 Geology

Biscayne Bay is bordered on the west by the mainland of peninsular Florida and on the east by both the Atlantic Ocean and a series of barrier islands consisting of sand and carbonate deposits over limestone bedrock. The bottom of Biscayne Bay is characterized by a thin layer of sediment less than 6 inches in depth over most of its area. However, sediment thickness in the northern part of the Bay near the City of Miami Beach is an average of approximately 40 inches. Miami Harbor typically has 1 to 8 feet (12 to 96 inches) of sands, clays or silts overlying limestone bedrock (Corps 1996a). The limestone has cavities and solution holes, which may be exposed or sediment-filled. This bedrock comprises two geologic formations. One is the Miami Oolite, which is composed of a permeable oolitic limestone, and the other is the Fort Thompson Formation which is composed of sandy limestones, sandstones, and sand seams. In the Miami area, the Miami Oolist and the Fort Thompson Formation combine to form the Biscayne Bay Aquifer, which serves as the primary source of drinking water for the south Florida area.

3.2.3 Sediment and Water Quality

The predominant sediments are largely composed of unconsolidated carbonate/quartz sands over limestone. The Corps and the EPA have recently pronounced the harbor sediments clean and appropriate for ocean disposal based on results of testing conducted over a 6-year period from 1992 to 1998 (Kimball-Murley, personal communication). Additionally, the *Final EIS Miami Ocean Dredged Material Disposal Site Designation (1995)* indicates that sediments removed from the Miami Harbor that are not beach quality sand or fine grained material are suitable for ocean disposal.

Since Biscayne Bay is classified as an Aquatic Preserve and an OFW, by law ambient water quality cannot be degraded below its existing level. However, certain previously dredged areas may be excluded from the OFW designation for particular waterbodies. Sources of water quality degradation in the Miami Harbor area mainly include stormwater discharges and runoff from the Miami River, Intracoastal Waterway and nearby land sources. There are no major chronic water quality problems that persist in the bay primarily due to its configuration as an open system that readily flushes out pollutants. However, in February 2002, the Service provided a Draft FWCA report to the Corps expressing our concerns related to possible degradation of water quality and possible contamination of portions of Biscayne Bay as a result of the proposed maintenance dredging of the Miami River.

3.2.4 Land Use

Except for Virginia Key, the natural and artificial islands within and adjacent to the project area are completely developed. These islands include: Dodge-Lummus, Fisher, Star, Palm, and Claughton Islands, Watson Park, and the barrier island comprising Miami Beach. Land surrounding Port of Miami waters is characterized by a mixture of low, medium and high-density residential areas; commercial enterprises; industrial complexes; office parks; and recreational areas. Specific features found to the north of the Port's Main Channel include the MacArthur Causeway (A1A), park/recreation and commercial facilities at Watson Island, the Terminal Island industrial area, and the U.S. Coast Guard Base at Causeway Island. Low-density residential uses are found beyond the MacArthur Causeway on Palm, Hibiscus and Star Islands. Medium and high density residential, park/recreation, commercial, and institutional land uses are found to the east of the port on Fisher Island and the southern portion of the City of Miami Beach. Located approximately one-half mile south of the port, across the waters of Biscayne Bay, is Virginia Key. Land uses found on Virginia Key include park/recreation, environmentally protected areas, and institutional and public facilities including the Miami-Dade County Virginia Key Wastewater Treatment Plant. Miami's Central Business District is found to the west of the Port.

4.0 FISH AND WILDLIFE RESOURCES

4.1 Biotic Communities

Habitats within the project impact area include seagrass beds; coral reefs and other hardgrounds; sand-, silt-, and rubble-bottom habitats; and rock/rubble habitats. Other habitats in the vicinity of the project include coastal strand and mangroves.

4.1.1 Coastal strand

Common plants associated with southeast Florida beach dunes include sea-oat (*Uniola paniculata*), sea-grape (*Coccolobis uvifera*), cabbage palm (*Sabal palmetto*), and palmetto (*Serenoa* spp.) (Kurz 1942). Dune species noted on Virginia Key included seashore paspalum (*Paspalum vaginatum*), dune sunflower (*Helianthus debilis*), and beach elder (*Iva imbricata*) (Grossenbacher, personal communication).

Miami-Dade County, the DEP, the City of Miami, and the Biscayne Bay Environmental Enhancement Fund are currently conducting dune and wetland restoration activities on Virginia Key (NOAA 2000). The vast majority of the terrestrial habitats adjacent to the project area are developed. Groins and bulkheads typically reinforce shorelines adjacent to the harbor's channels. Shoreline areas lacking these structures can be found on Miami Beach's Atlantic waterfront, portions of Fisher Island, and Virginia Key. In these areas, terrestrial habitats give way to dunes and beaches or transitional habitats such as wetlands, including those dominated by mangroves.

At least two species of dune vegetation protected by State and/or Federal law are known to occur on Virginia Key. Beach jacquemontia (*Jacquemontia reclinata*), listed as endangered by both U.S. Department of Agriculture and the State of Florida, and the beach peanut (*Okenia hypogaea*), a species endangered in the State of Florida, have been observed on the island, as has beach star (*Remirea maritime*), sea lavender (*Mallotonia gnaphalodes*), spider Lilly (*Hymenocallis latifolia*), and bay cedar (*Suriana maritime*) (Grossenbacher, personal communication).

The piping plover (*Charadrius melodus*), a migratory shorebird, is protected as a threatened species by the State of Florida and the Federal government, and is also protected under the Migratory Bird Treaty Act. According to the American Ornithologists' Union (1998), the species breeds in the northern Great Plains, the Great Lakes region, and Atlantic Coastal States/Provinces from New Brunswick to South Carolina. Individuals of the species winter along the Atlantic and Gulf Coasts from Texas to North Carolina, arriving on Florida's coasts in September and departing for the north in March. Foraging areas include intertidal beaches, mudflats, sandflats, lagoons, and salt marshes, where they feed on invertebrates such as marine worms, insect larvae, crustaceans, and mollusks.

The least tern (*Sterna antillarum*) is a small member of the gull family (Laridae) listed by

Florida as a threatened species (FWC 1997) and protected federally under the Migratory Bird Treaty Act. The eastern least tern population breeds primarily from coastal Maine through Florida (American Ornithologists' Union 1998). Florida populations arrive each year in mid- to late March to breed, and nests through mid-September, and typically choose open sandy substrates to form breeding colonies. Although typically nesting on open, sandy beach areas, an increasing number of colonies are located on open, flat, artificial surfaces (*e.g.*, warehouse roof tops). Least terns forage along coastal areas feeding on small fishes, as well as some crustaceans and insects. Individuals of this species have been noted on Virginia Key.

Species designated as "Species of Special Concern" by the State of Florida that have been found adjacent to the project area (specifically, on Virginia Key) include black skimmer (*Rynchops niger*), brown pelican (*Pelecanus occidentalis*), reddish egret (*Egretta rufescens*), roseate spoonbill (*Ajaia ajaja*), snowy egret (*Egretta thula*), tricolored heron (*Egretta tricolor*), and white ibis (*Eudocimus albus*) (Zambrano, personal communication). The presence of these species caused the State to create the Bill Sadowski Critical Wildlife Area at Virginia Key.

4.1.2 Mangroves

The mangrove strands on Virginia Key are of moderately high-quality (Curtis and Kimball Company 1999). These strands and those on Key Biscayne are important resources in Central Biscayne Bay due to the long-term decline of such communities in the general area (Harlem 1979) and their proximity to seagrass and hardbottom resources. The primary constituents of coastal wetlands on Virginia Key are black, red, and white mangroves (*Avicennia germinans*, *Laguncularia racemosa*, and *Rhizophora mangle*, respectively) with bottonwood (*Conocarpus erectus*), cordgrasses (*Spartina* spp.), sea daisies (*Borrichia* spp.), salt-grass (*Distichlis spicata*), and black rush (*Juncus romoerianus*) are other common occupants of saline coastal wetlands (BBPI, 2001).

Florida mangrove communities are known to support up to 220 species of fishes, 24 species of amphibians and reptiles, 18 species of mammals, and 181 species of birds (Odum *et al*, 1982). Mangrove habitats provide many important ecological functions, including providing refugia for juvenile stages of managed fish species, and have been identified as significant resources for seven species, and four subspecies, of federally protected species (Odum and McIvor 1990). Managed fish species associated with mangroves during at least one life-cycle phase include pink shrimp (*Penaeus duorarum*), spiny lobster (*Panulirus argus*), goliath grouper (*Epinephelus itajara*), gray snapper (*Lutjanus griseus*), black drum (*Pogonias cromis*), red drum (*Sciaenops ocellatus*), and snook (*Centropomus undecimalis*) (SAFMC 1998b).

In addition, mangrove communities provide valuable habitat for State listed species such as the mangrove rivulus (*Rivulus marmoratus*) and federally listed species such as sea turtles (*Lepidochelys kempi* and *Eretmochelys imbricata*), eastern indigo snake (*Drymarchon corais couperi*), wood stork (*Mycetaria americana*), and the American crocodile (*Crocodylus acutus*).

4.1.3 Seagrass

Seagrasses are a vital component of the coastal ecosystem by serving as a primary producer, providing forage habitat and shelter for multiple organisms, improving water quality and clarity, and providing substrate stabilization. Seagrasses are a highly productive, faunally rich, and ecologically important habitat within the coastal lagoons, bays, and estuaries of south Florida. Rapidly growing seagrass shoots provide food for trophically higher organisms via direct herbivory or from the detrital food web. The canopy structure formed by these shoots offers shelter and protection. This combination of shelter and food availability results in seagrass beds being the richest nursery grounds in South Florida's shallow coastal waters. As such, many important commercial and recreational fisheries (*e.g.*, clams, shrimp, lobster, fish) are associated with seagrass beds. Many of these recreationally and commercially important species rely on seagrasses for at least part, if not all, of their life history. Seagrass contributes to improving water quality and clarity by absorbing excess nutrients and trapping suspended solids. In addition, the roots and rhizomes of the seagrass help stabilize the substrate while the shoots of dense beds absorb wave energy, thereby buffering their effects on the shoreline.

Seagrasses have experienced declines in abundance and distribution due to water quality degradation and through the direct loss of habitat related to dredge and fill activities and boating impacts. The degradation of water quality is largely the result of point source pollution, such as wastewater discharge, agricultural runoff, and excessive freshwater discharge; non-point source pollution, such as, stormwater runoff and leaching from septic tanks); and the alteration of adjacent watersheds. The subsequent decline in seagrasses has significantly reduced the fisheries resources in south Florida. Implementation of several protective and restorative measures has improved water quality and radically reduced the rate of habitat loss within south Florida's estuaries. Such measures include the regulation of dredge and fill activities, the elimination of wastewater discharge to surface waters, the treatment of stormwater runoff, and the rehabilitation of adjacent watersheds.

Fauna utilizing seagrass beds range from invertebrates to top-level predators in multiple guilds. A few common species are bittium (*Bittium* sp.), sea urchins (*Lytechinus variegatus*), pen shell (*Atrina rigida*), pink shrimp (*Penaeus duorarum*), spiny lobster (*Panulirus argus*), pinfish (*Lagodon rhomboides*), spotted sea trout (*Cynoscion nebulosus*), red drum (*Sciaenops ocellata*), great blue heron (*Ardea herodias*), roseate spoonbill (*Ajaia ajaja*), osprey (*Pandion haliaetus*), West Indian manatee, and green sea turtle (USDOI 1982).

Of the seven species of seagrass occurring in Florida, at least five species are found in waters of Miami-Dade County. Species common to the Biscayne Bay include shoal grass (*Halodule wrightii*), manatee grass (*Syringodium filiforme*), turtle grass (*Thalassia testudinum*), star grass (*Halophila englemannii*), paddle grass (*Halophila decipens*), and Johnson's seagrass. A recent survey of known seagrass habitats adjacent to the project area (DC&A 2001) included the area 400 feet south of Fisherman's Channel, including the area within the Bill Sadowski CWA, the area adjacent to the Coast Guard Station, the Entrance Channel, and the area 500 feet north and south of the offshore channel. Seagrasses were observed in 25 of the 35 survey transects. Significant seagrass resources were found bordering Fisherman's Channel, south and southwest of Dodge Island, and north of the Fisher Island Turning Basin (Figure 2). Observed seagrass species included shoal grass (*Halodule wrightii),* paddle grass *(Halophila decipiens),* manatee grass (*Syringodium filiforme),* and turtle grass *(Thalassia testudinum).* Seagrass communities consisted of mixed beds of *H. decipiens* and *H. wrightii*, mixed beds of *H. wrightii,* and *T. testudinum,* mixed beds of *T. testudinum* and *S. filiforme,* mixed beds of all four species; and monospecific beds of *T. testudinum*, and *H. decipiens*. No Johnson's seagrass (*H. johnsonii),* the only federally protected seagrass species, was observed in the 35 survey transects (DC&A 2001). Quadrats, placed at 10-meter intervals within each transect, were used to assess frequency of occurrence and coverage for each species. The overall, average frequencies of occurrence for *S. filiforme, H. wrightii, T. testudinum,* and *H. decipiens* were 36, 29, 19, and 15 percent respectively. If at all present in sampled transects, average percent-area coverage for each species was between 5 and 25 percent. Percent-area coverage was greatest for *S. filiforme* (approximately 21 percent), followed by *H. wrightii* (approximately 19 percent), *T. testudinum* (approximately 15 percent), and *H. decipiens* (approximately 9 percent). Among all available habitat sampled using quadrats, percent-coverage was less than 5 percent for each species.

Seagrass communities provide important habitat for many different species of flora and fauna. *Caulerpa prolifera* was recently observed in video transects of *H. wrightii* (DC&A 2001), and algae of the genera *Halimeda, Udotea*, and *Penicillus* have also been identified as associates of seagrasses in southeastern Florida (Zieman 1982). Many invertebrate species also utilize seagrass communities. The most obvious inhabitants include queen conch (*Strombus gigas*); urchins, including the long spine urchin (*Diadema antillarum*); nudibranchs; bivalve mollusks; crustaceans, including spiny lobster (*Panulirus argus*); and blue crab (*Callinectes sapidus*). In some shallow areas, various soft corals and sponges were observed scattered within and adjacent to patches of seagrasses (DC&A 2001). Many fish species have also been shown to have life cycles dependent on seagrass beds. Of particular importance are mullet (*Mugil cephalus*), snook (*Centropomis undecimalis*), and many prey species, such as pinfish (*Lagodon rhomboides*) and mojarras (family Gerreidae). Seagrass beds are also important nurseries for many of the fish associated with snapper-grouper complex (SAFMC 1998b).

4.1.4 Unvegetated Softbottom and Rock/Rubble Habitats

Softbottom areas are defined as areas where hard substrates are covered by more than 5 inches of sediment (Corps 1989). Furthermore, for the purposes of classification, "unvegetated softbottom habitats" may include those with small-diameter rubble left over from previous dredging events and/or those supporting isolated macroalgae beds. Even without vegetation, this subtidal may provide a corridor for reef species to travel between reef lines and these areas may also be important foraging areas for some fish species (Jones *et al.* 1991). Many unvegetated softbottom habitats are located between seagrass beds, between scattered reef patches and between rock/rubble habitats both within and adjacent to the channel (Figure 3). In addition, unconsolidated sediments can be found along the south margin of Fisherman's Channel and in the area south of Dodge Island (based on data from Corps 2001).

The biota that comprises the subtidal zone include benthic invertebrate assemblages, epifaunal invertebrates, and macrophyte assemblages that form reef communities where hard substrate is present for colonization, and the fish and motile crustacean species that utilize this habitat. The organisms associated with the nearshore surf zone and deeper subtidal sand bottom habitats are generally dominated by polychaetes, amphipods, isopods, decapods, mollusks, echinoderms, and a variety of other taxa. The most ubiquitous infauna of inshore softbottom communities of the project area likely include: polychaete and sipunculan worms, oligochaetes, platyhelminthes, nemerteans, mollusks, and peracarid crustaceans. Compared to shallow sand flats, seagrass communities, and areas adjacent to reef tracts, the deeper, dredged areas of the channel and harbor likely support a less-diverse infaunal species assemblage. Other frequent occupants of these habitats include benthic fishes (*e.g.*, flounders), bivalves, decapod crustaceans, and certain shrimp species.

Softbottom substrates in Biscayne Bay, channel zones, and offshore areas that are generally unvegetated support isolated algae, coral, or sponge colonies, but are on average much less diverse in terms of habitat and species assemblages than are hardgrounds, reefs, or seagrass beds. During the summer months, the most abundant algal species in the project area belong to the green algae genera *Caulerpa*, *Halimeda*, and *Codium* (Corps 1996b). In winter months, brown algae (*Dictyota* spp. and *Sargassum* spp.) dominate (Corps 1996b). In addition, several species of sponges (*e.g.*, *I. campana*, *C. vaginalis,* and *Iotrochota sp.*) and gorgonians (*e.g.*, *Eunicia* spp. and *Gorgonia* sp.) were observed during transects through softbottom habitats (DC&A 2001). Individual colonies of algae, soft corals, and sponges that occasionally occur in these areas where little structure is available may serve to provide temporary refugia for small, motile species. Invertebrate fauna utilizing softbottom areas include the Florida fighting conch (*Strombus alatus*), milk conch (*Strombus costatus*), king helmet (*Cassia tuberosa*), and the queen helmet (*Cassia madagascariensis*) (Corps 1996b).

Rock/rubble habitats scattered over expanses of softbottom habitats is the most common community type in the channel west of Cut 2 of the entrance channel. Rock/rubble substrates within the project area may comprise either naturally occurring rock outcrops or rubble material that has been left from prior dredging events. These substrates provide structure for use by fishes and motile invertebrates, and may also provide surfaces for attachment of reef-building corals and sessile organisms, such as sponges. In deeper zones (the channel bed), where rock/rubble habitats are subjected to lower light levels, biodiversity is typically much lower than in shallow waters or in moderate depths.

Rock/rubble habitats can be further classified according to dominant sessile biota. One such biotic community is dominated by sponges and macroalgae, the other by sponges and occasional octocorals. The algae/sponge communities consist of the sponges *Ircinia* sp., *Niphates* sp., *Cliona* sp., and *Iotrochota* sp., and dominant algae are *Caulerpa* sp., *Jania* sp., *Laurencia* sp., *Dictyota* sp. and *Halimeda* sp. (Corps 1989; Dodge 1991; Vare 1991). Interspersed among the sponges are colonial anemones (*Zoanthus* sp.) and hydrocorals (*Millepora alcicornis*). The sponge/coral community may develop given adequate water depth and clarity, and if there is a nearby source population. This was apparent in the channel zone, including the channel walls, adjacent to the existing reef tracts, and may be considered "rock/rubble with livebottom" (DC&A 2001). Observed sponge species included *Ircinia campana*, *Callyspongia vaginalis*, and *Iotrochota* sp. (possibly *I. birotulata*) (DC&A 2001). Observed soft corals were similar to those of adjacent reefs, and included the genera *Eunicea Plexaura* and *Pseudopterogorgia* (DC&A 2001). Habitats provided by rock and rubble and associated sponges, algae, and soft corals provide significant refugia many species of invertebrates and juvenile fish species.

4.1.5 High- and Low-Relief Hardbottom Reef

Nearshore and offshore low-relief hardbottom are characterized by limestone, rock, or worn coral substrates that contain crevasses, holes, and low-lying ledges that create microhabitat diversity, and thereby can support higher species diversity than unvegetated, softbottom habitats. Low-relief hardbottom habitats are important for organisms such as crustaceans, notably, crabs, spiny lobster, and penaeid shrimp and numerous fishes, including species of the Snapper-Grouper complex. Several species utilize hardbottom as refugia during juvenile life-history stages, whereas adults of various predatory species use these areas as foraging grounds.

Hardbottom fauna may be divided into sessile and motile components. The sessile component contains the primary producers, such as macroalgae; some grazers or first order consumers, planktivores, and filter feeders. Hard corals occupy niches as both producer and consumer. Zooxanthellic algae within coral polyps photosynthesize while the polyps themselves capture planktonic organisms for consumption. Similar to hard corals, tunicates and sponges concentrate carbon that is typically fixed far offsite. These attached filter-feeding organisms contribute to the organic base by trapping nutrient-rich plankton as it is swept past by wave and wind generated currents. Tunicates, sponges, and hydroids add structure to the bottom, providing shelter from predation for many crustaceans and smaller fishes.

Hardbottom and coral reef habitats associated with the project area include a nearshore hardbottom area and three additional parallel reef tracts that run generally north/south (Figure 3). The hardbottom zone nearest to shore exists in a physically stressed environment, and involves the Miami Oolite Formation (Hoffmeister *et al.* 1967). Offshore from this nearshore hardbottom area, there are three parallel reef tracts (Duane and Meisburger 1969). The first reef occurs approximately 100 to 2000 feet from shore, the second reef is located 3,000 to 6,000 feet offshore, and the third reef is approximately 8,000 feet or more offshore. There is an extensive sand area located between the second and third reef lines. The area between the first and second reef lines is characterized by small isolated hermatypic coral heads and interspersed coral rubble, with areas of open sand (DC&A 2001).

Reef habitats within the channel are generally restricted to areas where reef tracts were bisected by dredging (Figure 3). It seems corals and sponges colonized rock/rubble deposited during dredging activities in those areas over the last 10 years. The highest profile reefs within the channel are associated with the two outermost reef tracts, but the re-colonized area within Cut 2 also possesses significant biodiversity. These areas grade into either lower-profile habitats that sustain gorgonians, or rock/rubble habitats supporting sponges and algae.

Live hardbottom and coral reef communities in the offshore areas of the study area are predictably speciose and have been characterized several times (Seaman 1985; Blair and Flynn 1989; and Corps 1989). The dominant feature of the reefs and hardgrounds (low- and high-relief habitats) off Miami-Dade County is the high density and diversity of gorgonian corals (Corps 1996a). Gorgonians observed during the 2000 survey were primarily of the genera *Eunicea* (*e.g.*, *E. palmeri)*, *Plexaura* (*e.g.*, *P. homomalla)*, and *Pseudopterogorgia*. Other observed genera included *Gorgonia*, *Plexaurella* (possibly *P. dichotoma)*, and *Pterogorgia* (possibly *P. citrina* and *P. anceps),* and possibly *Pseudoplexaura* (DC&A 2001). Hard coral species also make up a significant part of the reef assemblages in this area. They include *Porites asteroides, Diploria clivosa, Siderastrea siderea,* and *Montastrea cavernosa* (Blair and Flynn 1989). All four of these dominant species, and a fifth, *Montastrea annularis*, were observed during the 2000 survey (DC&A 2001). Sponges observed within the project area's hardgrounds and reefs during that survey included *Ircinia campana*, *Callyspongia vaginalis*, *Cliona* sp., *Iotrochota* sp. (possibly *I. birotulata*), Geodia spp. (possibly *G. gibberosa* and *G. neptuni*) and possibly *Amphimedon compresa* (DC&A 2001). The biota of the three outer reef tracts is consistent with the overall assemblage of stony corals, sponges, and gorgonians found offshore of Miami-Dade, Broward, and Palm Beach counties (Corps 2000). Colonizing taxa such as sponges and certain gorgonians were more prevalent in the channel's hardbottom areas then were hard corals. Observed algal species in both channel and offshore areas included *Caulerpa* spp., *Laurencia* spp., *Cladophora* spp., and *Halimeda* spp. (DC&A 2001). Flynn, *et al.* (1991) noted the additional presence of *Dictyota* spp. and *Jania* spp. in the area.

A recent survey in offshore reef habitats resulted in the observation of 28 species of fish on the offshore reef sites (DC&A 2001). A summary of the species observed is shown in Table 1. The most abundant species encountered were cocoa damselfish (*Pomacentrus variabilis*), bicolor damselfish (*Pomacentrus partitus)*, barjack (*Caranx ruber*), and bluehead wrasse (*Thalasomma bifasciatum*). Many other fishes were commonly or occasionally encountered within the study area. These included members of the families Chaetodontidae (butterflyfishes), Acanthuridae (surgeonfishes), Scaridae (parrotfishes), Labridae (wrasses), Haemulidae (grunts), Lutjanidae (snappers), and Pomacanthidae (angelfishes). Other species encountered in lesser numbers included hogfish (*Lachnolaimus maximus*), rock hind (*Epinephelus adsecnsionis*), and Spanish hogfish (*Bodianus rufus*). These results are similar to fish species observed by Bohnsack *et al.* (1992 and 1999).

4.1.6 Essential Fish Habitat

The community types listed above are considered Essential Fish Habitat (EFH) as described in the Magnuson-Stevens Fishery Conservation and Management Act, as amended by the

Sustainable Fisheries Act of 1996 (Public Law 104-267). EFH provisions support the management goals of sustainable fisheries. EFH that may be directly and indirectly impacted by the proposed project are likely to include the water column, littoral zone, sublittoral zone, hardbottom, and seagrass habitats. Specific aspects of EFH that may be adversely affected include spawning, foraging, predator/prey relationship, and refuge habitats for such managed species such as the snapper/grouper complex, penaeid shrimp, and spiny lobster. The NMFS is the lead agency responsible for the complete assessment of the possible adverse impacts of the proposed project to EFH.

The SAFMC (1998b) has designated mangrove, seagrass, nearshore hardbottom, and offshore reef areas within the study area as Essential Fish Habitat. The nearshore bottom and offshore reef habitats of southeastern Florida have also been designated as Essential Fish Habitat- Habitat Areas of Particular Concern (EFH-HAPC) (SAFMC 1998b). Managed species that commonly inhabit the study area include pink shrimp (*Farfantepenaeus duorarum*), and spiny lobster (*Panularis argus*). These shellfish utilizes both the inshore and offshore habitats within the study area, including macroalgae beds (*e.g.*, *Laurencia* spp.). Members of the 73-species snapper-grouper complex that commonly use the inshore habitats for part of their life cycle include blue stripe grunts (*Haemulon sciurus*), French grunts (*Haemulon flavolineatum*), mahogany snapper (*Lutjanus mahogoni*), yellowtail snapper (*Ocyurus chysurus*), and red grouper (*Epinephelus morio*). These species utilize the inshore habitats as juveniles and sub-adults and as adults utilize the hardbottom and reef communities offshore. In the offshore habitats, the number of species within the snapper-grouper complex that may be encountered increases. Other species of the snapper-grouper complex commonly seen offshore in the study area include gray triggerfish (*Balistes capriscus*), and hogfish (*Lachnolaimus maximus*). Coastal migratory pelagic species also commonly utilize the offshore area adjacent to the study area. In particular, king mackerel (*Scomberomorus cavalla*) and Spanish mackerel (*Scomberomorus maculatus*) are the most common. As many as 60 corals can occur off the coast of Florida (SAFMC 1998b) and all of these fall under the protection of the management plan.

Snook (*Centropomus undecimalis*), an important gamefish in the State of Florida, is currently listed as a species of special concern by the State of Florida (FWC 1997). The species is associated with several habitats found within the project area. Another species listed by the State as a Species of Special Concern is the mangrove rivulus (*Rivulus marmoratus*). These small fish likely occupy mangrove habitats associated with Virginia Key.

As described in the Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), the EFH provisions of the act support the objective of maintaining sustainable fisheries. Mitigation would be required for first-time impacts to seagrass beds and reef/hardbottom habitats. In addition, mitigation will not be required for dredging softbottom habitats lacking seagrasses or for habitats with rubble substrates within the channel since dredging was previously performed in the channel.

The focus of the mitigation policy is to conserve and enhance EFH and to avoid, minimize, and thereafter compensate for impacts to EFH due to development activities. Like other Federal agencies with regulatory responsibilities, the first priority of the NMFS is to advocate avoidance of impacts to natural resources when presented with any development plan. However, when unavoidable impacts to EFH are proposed, NMFS may recommend mitigation measures to compensate for any loss of resource value. Recommendations may include restoration of riparian and shallow coastal areas (*i.e.*, reestablishment of vegetation, restoration of hardbottom characteristics, removal of unsuitable material, and replacement of suitable substrate), upland habitat restoration**,** water quality improvement or protection, watershed planning, and habitat creation. The preferred type of mitigation is enhancement of existing habitat, followed by restoration, and finally creation of new habitat.

4.2. Threatened and Endangered Species

4.2.1 West Indian manatee

The West Indian manatee is known from coastal areas of Beaufort, North Carolina through Florida and the Gulf of Mexico. Manatees frequently inhabit shallow areas where seagrasses are present and are commonly found in protected lagoons and freshwater systems. In winter, they frequently move into areas where water temperatures are mitigated by spring-fed streams or power generation plan effluent. In general, very few manatees are present in the offshore waters from November through April. However, during the remainder of the year, manatees occasionally use open ocean passages to travel between favored habitats (Hartman, 1979).

The manatee has been listed as a protected mammal in Florida since 1893, and is also protected under the Marine Mammal Protection Act (MMPA) of 1972 and the ESA of 1973. Florida provided further protection in 1978 by passing the Florida Marine Sanctuary Act designating the state as a manatee sanctuary, and providing signage and speed zones in Florida's waterways. All of Biscayne Bay has been designated as Critical Habitat under the ESA. Adjacent to the project area, a *No Entry* zone within the Bill Sadowski CWA has been established for manatee conservation purposes.

Within Miami-Dade County there exist both permanent and transient populations of manatees. Surveys show that during the winter months when temperatures drop, manatees from north Florida and also Miami-Dade County will migrate to the Florida Power and Light's power plants at Port Everglades and Fort Lauderdale (USGS 2000). During the summer months when the water warms, manatees return to the counties to the north and south to forage and reproduce. Telemetry and aerial surveys confirm manatees are present within Miami-Dade County all year (Miami-Dade County 1995, and USGS 2000) (Figure 4).

Historical records regarding manatees in South Florida are sparse. Manatees are mentioned in documents that are dated as early as the mid 1800's and early 1900's (O'Shea 1988). Moore (1951) indicated that manatees commonly used the New River and the Miami River. He also noted a 1943 anecdotal observation of more than 100 manatees killed during the deepening of the Miami River Channel and a reference to 195 manatees aggregating at the Miami power plant discharge in 1956 (Mezich 2001). In general, the rivers, creeks and canals that open into

Northern Biscayne Bay were locations noted for their manatee abundance. These remain important habitats, particularly on a seasonal basis (Figures 2 and 3). In freshwater environments in Miami-Dade County (upper reaches of canals), manatees are feeding primarily on the exotic Hydrilla *Hydrilla verticillata*. During cooler weather, manatees feed on extensive meadows of seagrasses in many parts of Biscayne Bay.

The causes for manatee deaths in Miami-Dade County are varied (Table 3; Figure 4). The highest number of manatee deaths in Miami-Dade County result from water control structures. Floodgates often have qualities that are attractive to manatees. Freshwater is often available at floodgates, and is typically slightly warmer than the ambient water. An example of this situation is the floodgate on the Little River in Miami-Dade County. This site is known to attract manatees in winter during mild weather. This location has a 1-degree Celsius higher water temperature than surrounding areas and freshwater is available (Deutsch 2000). Also, freshwater vegetation is often washed down from upriver and made available when the gates are opened. Figure 5 demonstrates the location of water control structures near the project area. The second most frequent cause of manatee deaths in Miami-Dade County is boat-related injuries.

No deaths related to cold stress have been reported as shown on the table below. Miami Harbor is well within the historic range for the Florida manatee described by Moore (1951b), and therefore, water temperatures likely seldom reach stressing levels for extended periods of time. Also, power plants located to the north in Broward County have likely ameliorated cold-related stress.

Manatee deaths in Miami-Dade County from 1974 through 2001 (source: FMRI)

Year	Watercraft	Gate/Lock	Human/ Other	Perinatal	Cold stress	Natura l	Undetermined	Total
1974	2	0	0	0	0	0	0	2
1975	1	1	0	1	0	0	1	4
1976	2	4	0	0	0	1	8	15
1977	1	5	2	2	0	0	2	12
1978	2	8	0	0	0	0	2	12
1979	1	5	2	0	0	0	1	9
1980	0	2	0	0	0	0	0	2
1981	1	0	2	0	0	0	2	5
1982	0	2	0	0	0	0	2	4
1983	0	1	4	1	0	0	1	7
1984	1	0	0	0	0	0	0	1
1985	1	1	0	2	0	0	0	4
1986	1	0	1	0	0	0	0	2
1987	4	2	0	1	0	0	1	8
1988	1	6	0	0	0	1	1	9
1989	3	0	0	0	0	0	0	3
1990	1	1	0	0	0	0	2	4
1991	0	1	0	2	0	2	2	7
1992	4	1	1	1	0	1	2	10
1993	0	2	2	0	0	0	1	5
1994	1	4	3	1	0	1	1	11
1995	2	3	2	0	0	3	4	14
1996	0	3	0	1	0	0	3	7
1997	5	5	1	2	0	0	1	14
1998	2	3	1	0	0	0	3	9
1999	1	5	3	0	0	2	1	12
2000	2	2	2	0	0	0	2	8
2001	5	0	2	2	0	0	2	11
Totals	26	30	17	9	0	9	24	115

4.2.2 Sea Turtles

Miami-Dade County is within the normal nesting range of three species of sea turtles, all of which are listed under the ESA: the loggerhead, green turtle, and leatherback. The green and leatherback turtles are listed as endangered, whereas the loggerhead turtle is listed as a threatened species. On the 37.8 miles of beach surveyed within the Miami-Dade County, a total of
505 nests were found in 2001 (FMRI 2002a,b, & c). On Fisher Island, a total of 24 sea turtle nests were observed during 2000 (Miami-Dade County 2000). A summary of sea turtle nesting activity for Miami-Dade County is found in Table 2. The majority of sea turtle nesting activity

occurred during the summer months of June, July and August, with nesting activity occurring as early as March and as late as September (Miami-Dade County 2000). The waters offshore of Miami-Dade County are also used for foraging and shelter for the three species listed above as well as the hawksbill turtle and possibly the Kemp's ridley turtle.

4.2.3 American Crocodile

The American crocodile is a State and federally listed endangered species. The current range of the species in the southeastern United States includes coastal and estuarine habitats in the extreme southern Florida peninsula. Females nest primarily on northern Key Largo and from Florida Bay to Turkey Point. Nesting begins in March and extends until late April or early May. Approximately 90 days following fertilization, eggs are buried in sand or marl nests adjacent to deep water. Adult crocodiles feed at night on schooling fish in creeks, open water, and deep channels (FP&L 1987), and are also known to eat crabs, raccoons, and water birds.

Crocodiles have been observed throughout the Key Biscayne-Fisher Island-Biscayne Bay Area (Mazzotti 2000), and at least two to three individuals have been observed in the vicinity of Virginia Key (Zambrano personal communication). Recent observations within the vicinity of the project area have occurred at several localities on Key Biscayne (Crandon Park and Bill Baggs State Recreation Area), as well as scattered records of individual animals in Hollywood (Mazzotti personal communication) and Palm Beach, Florida, and as far north as Jupiter, Florida (Service 1999).

Critical habitat for the American crocodile includes all land and water within an area encompassed by a line beginning at the easternmost tip of Turkey Point, Miami-Dade County, on the coast of Biscayne Bay; southeast along a straight line to Christmas Point at the southernmost tip of Elliott Key; southwest along a line following the shores of the Atlantic Ocean side of Old Rhodes Key, Palo Alto Key, Angelfish Key, Key Largo, Plantation Key, Lower Matecumbe Key, and Long Key, to the westernmost tip of Long Key; northwest along a straight line to the westernmost tip of Middle Cape; north along the shore of the Gulf of Mexico to the north side of the mouth of Little Sable Creek; east along a straight line to the northernmost point of Nine-Mile Pond; northeast along a straight line to the point of beginning (50 CFR 17.95). The Port of Miami is not located within crocodile critical habitat.

4.2.4 Johnson's Seagrass

Johnson's seagrass was listed as a threatened species by NMFS on September 14, 1998, (63 FR 49035) and a re-proposal to designate critical habitat pursuant to section 4 of the ESA was published on December 2, 1998, (64 FR 64231). The final rule for critical habitat designation for the species was published April 5, 2000, (65 FR 17786). All areas adjacent to Miami Harbor channels fall within designated critical habitat.

Johnson's seagrass has one of the most limited geographic ranges of all seagrasses, and little is known about its natural history, biology, and ecology. Observations lending evidence for asexual reproduction and a limited capacity to store energy indicate that the plant may be especially vulnerable to human activity and natural impacts (NMFS 1998). It is known to occur only in lagoons between Sebastian Inlet and central Biscayne Bay on the east coast of Florida (NMFS 1998). Johnson's seagrass was not encountered within the study area during a widespread survey in 2001) (DC&A 2001). However, during the March 19, 2002, site visit, NMFS staff collected an unidentified blade that was thought to be Johnson's seagrass. The sample was collected just outside an area where proposed dredging may occur (at 25° 46' 04.3817" N latitude/ 80° 08' 25.7528" W longitude).

4.2.5 Smalltooth Sawfish

During 2002, the smalltooth sawfish (*Pristis pectinata*)was federally listed as an endangered species. This species of sawfish inhabits softbottom estuarine habitats in depths generally less than 30 feet. Its former range in United States waters extended from Texas through Maryland. Currently, few are observed outside peninsular Florida. At least one recorded observation has occurred in Biscayne Bay (NMFS 2000). Populations likely decreased due to a low intrinsic rate of natural increase, the long interval to time of reproduction, and human impacts, most notably overfishing, incidental take in nets (due in part to its body size and unusual morphology), and habitat loss (development of shoreline and nearshore habitats) (NMFS 2000).

4.2.6 Whales and Dolphins

The Northern right whale (*Eubalaena glacialis*) is a federally listed endangered species and is protected under the MMPA. The current migratory population within the Atlantic Region is less than 350 animals. Right whales are highly migratory and summer in the Canadian Maritime Provinces. They migrate southward in winter to the eastern coast of Florida. The breeding and calving grounds for the right whale occur off of the coast of southern Georgia and north Florida. During these winter months right whales are routinely seen close to shore and have been sighted as far south as south Florida, with isolated sightings into the Gulf of Mexico.

Since the project will occur nearshore, it is unlikely that endangered whale species, such as the fin whale (*Balaenoptera physalus)*, humpback whale (*Megaptera novaeangliae*), and sperm whale (*Physeter macrocephalus*) would be observed in the project boundaries. However, dolphins common to inshore waters of southeast Florida include the Atlantic spotted dolphin (*Stenella frontalis*), the spinner dolphin (*Stenella longirostris*), and the spotted dolphin (*Stenella attenuata*), and the bottlenose dolphin (*Tursiops truncates*), which is listed as *depleted* under MMPA. A resident population of bottlenose dolphins can be found in Biscayne Bay (Contillo in press).

5.0 DESCRIPTION OF RECOMMENDED PLAN AND ALTERNATIVES

The Corps indicated that a number of alternatives were originally considered, but during efforts to minimize adverse effect to the natural resources, many were eliminated from further analysis. However, three alternatives were analyzed in the EIS; Alternatives 1 and 2 were "action alternatives" while Alternative 3 was described as the "no action" alternative (Table 4). In addition, the existing channel dimensions and turning basin authorized depths are described in Table 3.

The recommended plan (Alternative 2) includes five components: (1) flaring the existing 500-foot wide entrance channel to provide an 800-foot wide entrance channel at Buoy 1, and deepening the entrance channel and widener from an existing depth of 44 feet to a depth of 52 feet; (2) widening the southern intersection of Cut-3 with Lummus Island (Fisherman's) Channel at Buoy 15, and deepening from the existing depth of 42 feet to 50 feet; (3) extending and truncating the existing Fisher Island turning basin to the north by approximately 300 feet near the west end of Cut-3, and deepening from 43 to 50 feet; (4) relocating the west end of the main channel to about 250 feet to the south, which will not require dredging; and (5) increasing the width of Lummus Island Cut (Fisherman's Channel) by approximately 100 feet to the south of the existing channel, reducing the existing size of the Lummus Island (or Middle) turning basin to a diameter of 1,500 feet, and deepening from the existing 42-foot depth to 50 feet. Alternative 1 included these five components and a sixth component that involved the deepening of Dodge Island Cut and creation of another turning basin which would have resulted in the permanent removal of approximately 25 acres of seagrass habitat (Figures 5, 6, and 7).

Sand, silt, clay, soft rock, rock fragments, and loose rock will be removed via traditional dredging methods. Where hard rock is encountered, the Corps anticipates that contractors will utilize other methods, such as blasting, use of a punch-barge/pile driver, or large cutterhead equipment. Blasting will be implemented only in those areas where standard construction methods are unsuccessful. Dredged/broken substrates will be deposited at up to four locations. Some rock and coarse materials will be transported by barge and placed at an artificial reef site as mitigation for impacts to hardbottom communities. Other rock/coarse materials will be placed in a previously dredged depression in North Biscayne Bay as part of construction measures to create seagrass habitat adjacent to the Julia Tuttle Causeway. The balance of rock and coarse materials that cannot be utilized will be transported to the Offshore Dredged Materials Disposal Site (ODMDS). Viable sand dredged from inshore areas will be relocated and used as a sand cap for the seagrass mitigation site. The balance of sand will be placed on a permitted, upland disposal area on Virginia Key, for possible future use as beach renourishment material on Virginia Key.

With the alteration of the planned configuration and size of the Fisher Island Turning Basin that took place during the plan formulation phase of this project, impacts to seagrasses were altogether avoided at that location, except for some possible impacts due to side-slope erosion. By recommending Alternative 2 rather than Alternative 1, the Corps will further significantly reduce seagrass impacts. However, there will be an appreciable loss of seagrass (6.24 acres) as a result of Component 5. Minimization of indirect impacts to habitat resources, such as surrounding seagrass beds, is addressed in Section 6.1.

In total, the Corps estimates that 6.3 acres of seagrass, 31.4 acres of low-relief hardbottom, 20.7 acres of high-relief coral reef, 123.5 acres of rock/rubble, and 236.4 acres of unconsolidated/ unvegetated benthic habitat will likely be adversely affected as a result of the expansion of Miami Harbor. However, many of these habitats occur in areas that were impacted during previous dredging activities within Miami Harbor. Therefore, the total impact of habitats not previously dredged include: 6.3 acres of seagrass, 0.6 acre of low-relief hardbottom, 2.7 acres of high-relief coral reef, 3 acres of rock/rubble, and 23.3 acres of unconsolidated/unvegetated benthic habitat.

5.1 Blasting Methodology

The Corps states that to achieve the deepening of the Port of Miami from the existing depth of minus 42 feet to project depth of minus 50 feet, pretreatment of the rock areas may be required. Blasting is anticipated for some or all of the deepening of the channel west of the Government Cut jetties, where standard construction methods have been unsuccessful. The Corps anticipates that about three blasts per day may be required to pre-treat approximately 1,500 cubic yards of material per blast. This equates to approximately 1,550 blast days or 4.2 years to complete the project, if all one drill vessel is used throughout the project area. The total volume to be removed in these areas is up to 2.3 million cubic yards. Channel excavation activities may occur in the following manner:

(1) Contour dredging with either bucket, hydraulic or excavator dredges to remove material that can be dredged conventionally and determine what areas require blasting.

(1) Pre-treating (blasting) the remaining above grade rock, drilling and blasting the "Site Specific" areas where rock could not be conventionally removed by the dredges.

(2) Excavating with bucket, hydraulic or excavator dredges to remove the pre-treated rock areas to grade.

(3) All drilling and blasting will be conducted in strict accordance with local, State and Federal safety procedures. Marine Wildlife Protection, Protection of Existing Structures, and Blasting Programs coordinated with Federal and State agencies.

In addition, industry standards and Corps, Safety & Health Regulations typically limit the weight of explosives to be used in each blast to the lowest poundage (approximately 90 pounds or less) possible to adequately break the rock. The blasting would consist of three blasts per day and removal of approximately 1,500 cubic yards per blast. This equates to about 520 blast days to complete the project (based on an assumption of one drillboat, and that the entire project area inside the jetties will require blasting). The following safety conditions are standard and will likely be implemented in conducting underwater blasting:

(1) Drill patterns are restricted to a minimum 8-foot separation from a loaded hole.
(2) Hours of blasting are restricted from 2 hours after sunrise to 1 hour before sunset to allow for adequate observation for protected species.

(3) Selection of explosive products and their practical application method must address vibration and air blast (overpressure) control for protection of existing structures and marine wildlife.
(4) Loaded blast holes will be individually delayed to reduce the maximum pounds per delay at point detonation, which in turn will reduce the mortality radius.
(5) The blast design will consider matching the energy in the "work effort" of the borehole to the rock mass or target for minimizing excess energy vented into the water column or hydraulic shock.

The U.S. Navy Dive Manual and the FWC Endangered Species Watch Manual the safety formula for an uncontrolled blast suspended in the water column, which is as follows:

R = 260 (cube root w)
R = Safety radius
W = Weight of explosives

The Corps contends this formula is conservative for the blasting being done in the Port of Miami since the blast will be confined within the rock and will not suspend in the water column.

5.1.1 Proposed Protection Measures

Because of the potential duration of the blasting and the proximity of the blasting to a Critical Wildlife Area, the Corps has indicated that in addition to the *Standard Manatee Protection Construction Conditions*, conservation methods will be included in the project design to reduce possible adverse effects to marine wildlife. The Corps recognizes that it is crucial to balance the demands of the blasting operations with the overall safety of the species. However, a safety radius that is excessively large will result in significant delays that prolong the blasting, construction, traffic and overall disturbance to the area. A radius that is too small puts the animals at too great of a risk should one go undetected by the observers and move into the blast area. Because of these factors, the goal is to establish the smallest radius possible without compromising animal safety and provide adequate observer coverage for whatever radius is agreed upon. The Service has provided suggestions concerning the blasting protocols in the Recommendations section of this FWCA report.

The Corps has indicated that aerial reconnaissance of the safety radius, where feasible, will be implemented and added to a boat-based and land support reconnaissance. Additionally, an observer will be placed on the drill barge for the best view of the actual blast zone and to be in direct contact with the blast contractor in charge.

5.1.2 Proposed Test Blast

Prior to implementing a blasting program a Test Blast Program (TBP) will be completed. The purpose of the TBP is to demonstrate and/or confirm the following:

(1) Drill Boat Capabilities and Production Rates
(2) Ideal Drill Pattern for Typical Boreholes
(3) Acceptable Rock Breakage for Excavation
(4) Tolerable Vibration Level Emitted
(5) Directional Vibration
(6) Calibration of the Environment

The TBP begins with a single range of individually delayed holes and progresses to the maximum production blast intended for use. Each test blast is designed to establish limits of vibration and airblast overpressure, with acceptable rock breakage for excavation. The final test event simulates the maximum explosive detonation as to size, overlying water depth, charge configuration, charge separation, initiation methods, and loading conditions anticipated for the typical production blast.

The results of the TBP will be formatted in a regression analysis with other pertinent information and conclusions reached. This will be the basis for developing a completely engineered procedure for Blasting Plan. During the testing the following data will be used to develop a regression analysis:

(1) Distance
(2) Pounds Per Delay
(3) Peak Particle Velocities (TVL)
(4) Frequencies (TVL)
(5) Peak Vector Sum
(6) Air Blast, Overpressure

5.1.3 Other Rock Removal Methods Considered

The Corps has investigated other alternatives to remove the rock in Port Everglades without blasting through the use of a punchbarge. It was determined that the punchbarge, which would work for 12-hour periods, strikes the rock below approximately once every 30-seconds. This constant pounding would serve to disrupt manatee behavior in the area, as well as impact other marine animals in the area. Using the punchbarge will also extend the length of the project temporally, thus increasing any potential impacts to all fish and wildlife resources in the area.

The Corps believes that blasting is actually the least environmentally impacting method for removing the rock in the Port. Each blast will last no longer than 25 seconds in duration, and may even be as short as 2 seconds, and will be spaced out twelve hours apart. Additionally, the blasts are confined in the rock substrate. Boreholes are drilled into the rock below, the blasting charge is set and then the chain of explosives is detonated. Because the blasts are confined within the rock structure, the distance of the blast effects are reduced as compared to an unconfined blast.

5.2 Proposed Mitigation

5.2.1 Seagrass

Mitigation for the loss of approximately 6.4 acres of seagrass bed impacted by project activities may entail seagrass habitat creation, enhancement, or preservation, or equivalent activities that supply ecological functions provided by impacted seagrass beds. The Corps proposes to fill 10.0 acres of borrow area(s) associated with construction causeways and other activities in the past 40 years. These areas located in North Biscayne Bay (Figure 8) will compensate for the loss of seagrass habitat as a result of the proposed project. It is anticipated that introduced substrates will be naturally colonized by seagrasses from adjacent areas. Further site evaluation (including seagrass surveys, bathymetric profiles within and adjacent to each area, the collection and analysis of sediment samples, measurement of ambient PAR and TSS levels) will be conducted at the site prior to final approval. Dredged material will either be hauled or pumped to the selected borrow area(s) based on engineering analysis, cost and recipient site conditions. It is anticipated that ambient depths will range from minus 2 feet to minus 6 feet MSL in the restored areas following restoration and that seagrass recruitment will occur rapidly by *H. wrightii* and *H. decipiens,* both of which likely occur within the shallow flats adjacent to these sites. Other species including *T. testudinum* and *S. filiforme* will also colonize the sites, but generally only after occupation by the early colonizing species previously cited. In the event that natural recruitment has not started within 12 months following excavation, methods to plant seagrass donor material will be initiated. Planting methods will be developed following guidance by Fonseca *et al* (1998) and peer review by NMFS and the Service. Detailed plans and specifications for the seagrass creation will be prepared and provided for agency concurrence prior to construction.

5.2.2 High- and Low-Relief Hardbottom Reef

As compensation for the permanent removal of hardbottom reefs outside of the existing channel, the Corps proposes: (1) mitigation for the removal of 2.7 acres of high-relief coral reef habitat at a ratio of 2:1 through the creation of 5.3 acres of high-complexity, high-relief artificial reef habitat and (2) mitigation for the removal of 0.6 acre of impact to low-relief hardbottom habitat at a ratio of 1.3:1 through the creation of 0.8 acre of low-complexity, low-relief artificial hardbottom habitat.

The two types of mitigation reefs to be constructed, high-relief, high complexity (HRHC) and low-relief, low-complexity (LRLC) reefs are illustrated in Figure 10. HRHC relief will range in profile from 3 to 6 feet, whereas LRLC will range from 1 to 2 feet. Limestone rock excavated from the channel bed and expansion area will be used in reef construction. If necessary, supplemental, quarried limestone will also be used.
The Corps has not proposed compensation for the temporal loss of function as a result of the removal of the biotic communities, such as soft corals, sponges, and hard corals, which are considered previously dredged hardbottom habitat. These communities have colonized the existing channel walls and bottom since the last Miami Harbor dredging events in 1991 (entrance and Fishermen's channel) and 1968 (Fisher Island Turning basin). The Corps states that mitigation for impacts to previously dredged hardbottom habitat has been compensated through the construction of a 15.9 mitigation reef in 1996 for impacts associated with the 1991 dredging event.

In addition, rock/rubble-based habitats and softbottom marine habitats that lack seagrass are not proposed for mitigation, since the Corps considered that this habitat type will remain after construction and will re-colonize rapidly after construction.

5.3 Proposed Monitoring

5.3.1 Seagrass Mitigation Areas

Based on the recommended monitoring frequency recommended by Fonseca *et. al.* (1998), a time-zero monitoring event will be performed and then the seagrass community will be monitored quarterly for year 1, semi-annually for year 2 and annually for years 3 to 5. Twenty paired, one-square-meter quadrats will be randomly placed within the created seagrass habitat each monitoring event. Random rather than fixed quadrats will be use so that the results are without bias (you can design fixed stations to minimize bias or better yet run multiple transects through entire site) and can be used to accurately generalize over the entire area. Replicate quadrats will be established in the adjacent, surrounding seagrass beds to serve as a control. The following data will be collected at each quadrat:

- Relative water depth
- Time
- Shoot counts
- Aerial coverage by photo-documentation
- Qualitative observations of natural seagrass recruitment and vegetative expansion of planting units

In addition to the above-listed data, the following data will also be collected for each monitoring event: tides, weather, water temperature, and wind. A staff gauge or piezometer will be installed to record tide level.

Survivorship rates will be assessed based on measurements within the paired 1-m^2 quadrats.

Abundance measurements will be made through visual and photographic assessment of percent aerial coverage by species. The 1-m^2 quadrat will be divided into 10 cm x 10 cm grid and the number of squares containing seagrasses will be counted to estimate cover.

In addition, percent aerial coverage will be equated to Cover Classes, based on the Braun-Blanquet technique, as follows:

Cover Class	Description
0	Absent
0.1	Solitary individual ramet, less than 5% cover
0.5	Few individual ramets, less than 5% cover
1	Many individual ramets, less than 5% cover
2	5% -25% cover
3	25% -50% cover
4	50% -75% cover
5	75% -100% cover

Seagrass success criteria shall be based on

(1) A target goal of greater than 3 percent and 6 percent coverage by the third and fourth years, respectively.

(2) A target goal of greater than 10 percent coverage (Cover Class 2 or higher) by the fifth year.

(3) Supplemental seagrass will be planted on 2 m centers if:

a) at the end of the third year there is less than 3 percent cover.
b) at the end of the fourth year there is less than 6 percent cover.
c) at the end of the fifth year there is less than 10 percent cover.

Panoramic photo-stations will be established and underwater photographic documentation of each quadrat will also be collected.

Aquatic macrofauna will be identified and quantified along transects established for seagrass monitoring. This identification will be performed prior to monitoring of seagrasses to minimize disturbance. Macrofauna observed within a 2-meter wide area (and from the sediment to water' s surface), centered on the established transect, will be recorded while traversing the entire length of the transect. Benthic fauna below the sediment surface will not be sampled. The following data will be collected for each transect:

- Identification of fauna to lowest practical taxonomic level
- Number of individuals of a given species (abundance)
- Number of species (diversity)
- Location of identified fauna (sediment surface, water column)
- Behavior of identified fauna (swimming, foraging, etc.)
- Time to complete transect

Finally, incidental faunal observations will be recorded.

Agencies to receive and review reports include the Miami-Dade County Department of Planning and Environmental Protection, the South Florida Water Management District, and the Corps. The following schedule incorporates the monitoring frequency recommended by Fonseca *et al.* (1998): a time-zero monitoring event, quarterly monitoring for year 1, semi-annually for year 2, and annually for years 3 to 5. The spacing of the monitoring events has been adjusted so that one monitoring event each year occurs during the summer, within the time of increased seagrass productivity:

Estimated Date	Activity
TBD	Earthwork begins
TBD	Earthwork completed
TBD	Planting completed
TBD	Time-zero report
TBD	First monitoring report (quarterly year 1)
TBD	Second monitoring report (quarterly year 1)
TBD	Third monitoring report (quarterly year 1)
TBD	Fourth monitoring report (quarterly year 1)
TBD	Fifth monitoring report (semi-annual year 2)
TBD	Sixth monitoring report (semi-annual year 2)
TBD	Seventh monitoring report (annual year 1)
TBD	Eighth monitoring report (annual year 2)
TBD	Ninth monitoring report (annual year 3)

5.3.2 Artificial Reefs

Artificial reefs constructed for mitigation must be monitored to ensure viability and adequate compensatory value. The monitoring program for the mitigation reefs will consist of both physical and biological components. Physical monitoring will assess the degree of settling of the reef materials, and biological monitoring will assess populations of algae, invertebrates, and fishes, as compared with concurrent control sampling of natural reefs. Monitoring will be conducted annually in the summer months. In order to supplement quantitative monitoring efforts and provide a permanent record of reef conditions and biota, each sampling effort will include a video transect swim covering the entire area of the mitigation reefs.

The degree of settling and/or sand covering will be assessed by measuring the relief at each of the permanent quadrat stations established as outlined below. Measurements will be taken with a weighted flexible tape from a point 1 meter shoreward of the quadrat benchmark to the surface of the water and from the top of the reef structure at the benchmark to the surface of the water, with the difference being the relief. The mean of five such measurements will be used to assess the degree of settling and/or sand covering of the materials. Changes in relief at the control reef quadrat benchmarks will be assessed by the same method.

6.0 EVALUATION OF RECOMMENDED PLAN

The evaluation of the Recommended Plan examines the potential adverse effects of project activities to fish and wildlife resources, listed species, and their associated habitats. Direct and indirect effects of the action on habitats within the project footprint and areas adjacent to the project are considered. Direct impacts may occur as a result of removal during dredging (or blasting) and as a result of side-slope equilibrium or sloughing of unconsolidated material along the channel walls within Biscayne Bay. Indirect effects such as turbidity associated with dredging or spoil deposition may effect seagrass, hardbottom, and/or coral reef habitat. Effects on habitats are discussed through examining biological communities, while effects of the project on important fish and wildlife taxa, such as protected species and managed species, are discussed in subsequent sections. The use of traditional dredging methods in addition to the use of explosives to deepen and widen specific channels is anticipated. The effects of blasting on commercially and recreationally important fish species, marine mammals, and marine reptiles were also considered. Impact acreage values were taken from the Miami Harbor, General Reevaluation Report Study, Draft EIS, currently in preparation by DC&A.

6.1 Fish and Wildlife Resources

The Recommended Plan would impact approximately 418.2 acres of marine resources, including impacts to seagrass beds, low- relief hardbottom, high-relief coral reefs, rock/rubble, and unconsolidated/unvegetated softbottom habitat, including impacts to 2.3 acres of epibenthic invertebrate communities that have colonized in the past 10 to 15 years on the channel wall. Component 4 and parts of Component 1 involve zones where dredging will not occur, but are nevertheless considered part of the project area. Impacts are quantified in Table 5, and illustrated in Figures 5 and 6.

In addition, delivery and deposition of dredged materials at the proposed seagrass compensation site, the Virginia Key upland disposal site, or the offshore dredged material disposal site may have consequences for fish and wildlife resources. Dredge anchors, pipelines, equipment, and dredged materials themselves may incidentally injure sensitive habitats, such as dunes, mangroves, and seagrass beds. In marine habitats, increases in turbidity will likely result from deposition of materials.

6.1.1 Coastal Strand

It is unlikely that coastal strand habitats will be directly affected during the construction of the recommended plan. Likewise, the species associated with these habitats will not likely be directly affected. Though, nesting bird species may be affected during the utilization of the spoil containment area on Virginia Key or by the noise associated with blasting. Also, erosion problems on Miami Beach, Fisher Island, and Virginia Key may be exacerbated as a result of increased harbor traffic and increased vessel size.

6.1.2 Mangroves

The principal mangrove area adjacent to the project area lies along the northwest side of Virginia Key. Mangrove wetlands are not located within the project footprint. Dredging, increased vessel traffic, and vessel size are not expected to be detrimental to the stability of nearby mangrove communities due to the location of the habitat, and the limited speeds vessels use in the channel. The mangroves fall within the manatee protection “No Entry Zone” section of the Bill Sadowski CWA.

The northern shore and mangrove habitats of Virginia Key comprise important breeding and nesting grounds for at least eight species of birds protected by the State of Florida (Zambrano, personal communication). While proposed dredging activities are not anticipated to affect bird populations, use of an adjacent area on Virginia Key for dredge disposal purposes may disturb individuals when nesting, mating, or foraging. However, noise generated during blasting or dredge operation may adversely affect wading birds particularly during the nesting season.

6.1.3 Seagrass

The greatest impacts of implementation of the Recommended Plan on seagrass beds would occur along Fisherman’s Channel as part of Component 5 (Figure 5). Seagrass bed margins that had been estimated by DC&A (2001) were further refined using data provided by Miami-Dade DERM. These data, in conjunction with project plans for channel boundaries, were used to calculate direct and indirect impact areas. Impacts as a result of Components 5 include the removal of 6.3 acres of seagrass beds along Fisherman’s Channel during dredging activities and includes the anticipated loss of 6.0 acres seagrass adjacent to the channel within the Bill Sadowski CWA. This acreage was calculated based on the expected acreage of seagrass to be removed during dredging, geologic data and previous erosion of soft substrates and seagrass habitats in the area adjacent to the channel. Based on their observations of unauthorized seagrass impacts related to previous channel dredging activities within the Port, DERM suggested that the Corps examine possible effects of dredging on adjacent softbottom habitats. The Corps determined that soft substrates along channels typically achieve an angle of repose of 7 (horizontal): 1 (vertical). The extent of indirect loss of seagrasses was based on this ratio and the depth of soft-substrate overburden adjacent to the proposed channel, which is approximately

12 feet, based on geotechnical data. The majority of seagrass loss in the area would involve 4.08 acres of a seagrass bed dominated by *T. testudinum* and *S. filiforme* that extends into the neighboring Bill Sadowski CWA.

The effects of Component 5 on fish and wildlife resources would be significant and result in an adverse affect to manatee Critical Habitat. Direct impacts associated with the destruction of seagrasses include the loss of habitat and functional values attributable to the habitat. The diminution of seagrass beds in the areas inside the proposed new channel areas and in areas immediately adjacent to dredging activities will result in the direct loss of forage habitat for

manatees, and the direct loss of habitat for seagrass bed residents and transients such as fishes and invertebrates. Dredging and sloughing will significantly increase water depth. Therefore, seagrass recovery is unlikely to occur upon the newly exposed substrate.

Indirect environmental impacts will result from implementation of Component 5. Based on sediment analysis, substrates along the southern margin of Fisherman's Channel comprise a considerable amount of fine materials (Corps 2001). Therefore, dredging will likely re-suspend fine sediments into the water column. Fisherman's Channel's strong tidal currents may redistribute suspended sediments to other areas both inside and outside the study area that support submerged vegetation. Possibly affected areas would include seagrass habitats immediately adjacent to the Channel (*i.e.*, directly south of the Fisherman's Channel and the seagrass beds south of the Dodge Island), as well as habitats inside the Manatee No Entry Zone, the Bill Sadowski CWA, and possibly other areas of the Biscayne Bay Aquatic Preserve. Resuspended particulate matter may appreciably decrease water clarity and consequently photosynthetic activity of seagrasses in these areas. Deposition of sediments on beds may have adverse effects. These effects include, but are not limited to, the displacement of, and/or alteration of, fish, invertebrate, and epiphyte communities.

Deepening/widening of the Fisher Island Turning Basin, which is part of Component 3 will not impact seagrass communities via direct removal of substrate, but may affect up to 0.14 acres of beds located directly northeast of the proposed dredging limits due to substrate sloughing. The habitat that may be affected is a large mixed-species bed of *H. decipiens* and *Halodule wrightii*. That bed and another to the southeast (an isolated *Halophila decipiens* bed associated with the littoral zone of Fisher Island) may also be affected by dredging activities. These beds may temporarily experience decreased productivity due to decreases in water clarity, but this may not be very likely, as sediments to be dredged lack silt, clays, and silty sands.

For the remaining three project components (1, 2, and 4), direct and/or indirect impacts to seagrass beds will likely be minor or undetectable. Impacts that may occur due to Component 2 (widening the channel at the intersection of Government Cut and Fisherman's Channel) will be extremely minor. Resources within 2000 feet of the proposed dredge site for that component include only an isolated *H. decipiens* bed (over 500 feet away), and a large mixed-species (*H. decipiens* and *Halodule wrightii*) bed (over 750 feet away). Material to be dredged as a part of Component 2 principally comprises limestone, sandstone, and clean quartz sand (Corps 2001). Therefore, precipitation of fine particulate matter onto the seagrass beds will not occur due to the lack of resuspension of such materials. Component 1 falls outside the Bay and inner channels and is not likely to cause direct or indirect impacts to seagrasses. Component 4 does not involve any dredging activity; therefore, the seagrass beds identified during the 2000 survey (DC&A 2001) will not likely be adversely affected.

6.1.4 Unvegetated Softbottom Habitats and Rock/Rubble

Unvegetated softbottom habitats comprise a significant proportion or the total area proposed to be dredged. Although these habitats may be minor associates of other major habitat categories (such as seagrass beds, rock/rubble, or reef), substrata were not categorized as "unvegetated softbottom" during recent surveys (DC&A 2001) unless the condition was clearly dominant. Wide expanses of this type of community are found only in the area comprising Component 1, but smaller tracts are also present adjacent to seagrass habitats along the south side of Fisherman's Channel. Direct impacts to softbottom communities (due to dredging operations) in all three of these areas would include the destruction or displacement of both benthic epifauna and infauna, such as crustaceans, polychaetes, and small fishes. Iverson and Beardsley (1974) did not expect population effects on these taxa to be severe. However, direct and/or indirect effects may be more detrimental, based on the general location of the impacts. For example, in offshore areas, scattered or isolated patches of sessile colonial taxa, such as sponges and gorgonians, may also be removed with sediments. However, in the harbor and inshore channels, water clarity and depth limits growth of such species, and the only common taxa providing structure may be occasional macroalgae. In offshore areas, indirect impacts to reefs adjacent to softbottom habitats may occur. Marszalek (1981) found that reef areas adjacent to dredge zones were susceptible to the effects of the deposition of silt.

In total there would be 68.2 acres of unvegetated habitat impacted during dredging under Component 1. The vast majority comprises previously dredged substrate (66.9 ac). As long as the areas remained as viable aquatic habitat following dredging, benthic infaunal populations in these areas would re-colonize. Whether the substrate remains viable for benthos may depend on the degree to which light attenuates with the additional 8 feet of depth. Increased depth may not promote the growth of macroalgae and epipsammic algae.

Impacts to unvegetated habitats with Component 3 would entail the direct removal of 24.4 acres of unvegetated softbottom habitat, 19.1 acres of which has been dredged previously. Indirect impacts of dredging to seagrasses in this area would be like those described above, such as turbidity and sediment deposition effects. Impacts to benthos and infauna, and possibly corals, would likely occur, as described above.

As with other components, the largest impacts with Component 5 would be impacts to areas left from previous dredging activities within Miami Harbor. Approximately 127.1 acres of the area proposed to be dredged under Component 5 includes unvegetated bottom and rubble left from previous dredging activities. An additional impact to 16.7 acres of softbottom that has not been dredged previously is also required to complete this part of the project.

Proposed impacts to rock/rubble habitats are principally in areas that have already been dredged (Table 5), comprising approximately 123.5 acres. In much of the project area, where rock/rubble is present, sponges and algae have re-colonized these substrates that were deposited as a result of previous dredging activities. On 51.7 acres of substrate planned for re-dredging, soft corals have developed isolated colonies among sponges. Re-dredging these areas will return these substrates to a barren state, but re-colonization by invertebrates and utilization by fishes will likely follow.

6.1.5 High- and Low-Relief Hardbottom Reef

Widening and deepening of Miami Harbor's entrance channel to implement Component 1 would result in both direct and indirect impacts to hardbottom and reef communities (Table 5 and Figure 6). At least 31.4 acres of low-relief hardgrounds and 20.7 acres of high-relief reef will be impacted in total (49.4 acres, not including impacts to channel wall habitats). Most of the hardbottom and coral reef habitat to be impacted lies on substrates that have been previously dredged, whereas some habitats lie outside the channel zone and have substrates that have never been dredged.

6.1.5.1 Direct Impacts Inside the Existing Channels

Deepening the channel will impact a total of 31.4 acres of low-relief hardgrounds and 20.7 acres of high-relief reef that currently exist in the channel bed. In addition, the proposed project will destroy approximately 2.3 acres of low-relief hardbottom habitat located on the limestone walls of the existing channel that has colonized in the past 10 to 12 years during the deepening of the channel. As the inshore channels are widened, this activity will impact approximately 7,750 linear feet of wall, specifically along the south wall of Fisherman's Channel (Component 5) and the south wall of the entrance channel just north of Fisher Island (Component 2). These walls include as much as 2.3 acres (7000 feet in length by estimated 15 foot in depth of production surface along Fisherman's Channel) and 0.26 acres of vertically oriented hardbottom habitats (750 feet in length x 15 foot in depth along entrance channel). Based on bathymetric data, the Corps states that only a negligible amount of wall will be impacted where widening is proposed in the offshore entrance channel. In that area, the depths increase from approximately minus 44 to minus 47 feet within a high-relief habitat. Because these habitats are already defined by reef substrates having profiles from 3 to 6 feet, the habitat attributable to channel wall height contributes no more habitat value than the surrounding reef. Other areas where channel wall impacts may occur were considered in conjunction with geotechnical data (Corps 2001) to determine hardbottom impacts. Impacts to channel walls along the west and north side of the proposed Fisher Island Turning Basin (Component 3) affect sandstone surfaces, which presumably comprise less suitable habitat for managed species and limestone-affiliated biota.

Hard substrates such as outcrops, rocks, and exposed hardbottom form the backbone of a diverse, and economically and ecologically important ecosystem. Even though the existing channel has been dredged in the past, the substrates still exist within the channel, and, therefore, their value to fish and wildlife is considerable. Impacts to the 2.3 acres of invertebrate communities would result in direct removal of colonies of many coral species, including both reef-building species and gorgonians, which occur in this area at a high density. These corals provide important habitats for a myriad of fishes and invertebrates. Assemblages of sessile organisms in previously dredged areas may recover and reach the functional value of hardbottom habitats currently found in the channel in approximately 10 to15 years (based on current community structure and time elapsed since last dredging).

6.1.5.2 Direct Impacts Outside the Existing Channels

Widening at the eastern end of the entrance channel would result in both direct and indirect impacts to hardbottom and reef communities that have never been dredged. Specifically, 2.7 acres of high-relief reef and 0.6 acre of low-relief hardbottom will be affected. Direct impacts involve the destruction of both reef organisms and reef habitats. Though this habitat has not been previously dredged, this habitat has been impacted during several vessel grounding events.

The outermost reef tract is one of the most important reef resources in southeast Florida. Its distance from shore and the harbor result in increased health and less disturbances in comparison to the other two reef tracts. The reef habitats are significant resources due to their high biodiversity, which comprises dense populations of managed fishes and invertebrates and numerous colonies of hard and soft corals and sponges. Impacts to this reef habitat will decrease the offshore ecosystem's carrying capacity for many reef-dependent invertebrate and vertebrate species, including managed species. Therefore, loss of coral reef habitat will likely result in changes at the population level for many species, and possibly an overall change in fish community structure. Individual coral colonies, which may have taken hundreds of years to form, will be entirely lost. However, most of the ecological functionality of coral and sponge assemblages in dredged areas may recover in approximately 30 years (Banks *et al.*, 1998, used a "very conservative" 35-year recovery period in an assessment of another site).

6.1.5.3 Indirect Impacts

Indirect impacts to hardbottom and reef habitat associated with the project (*i.e.*, Component 1) may include physical damage or temporary environmental changes to the habitats adjacent to the area being dredged. Dredge equipment or dislodged rocks or limestone could collide with and crush nearby coral reef. Likewise, errors in blast engineering could cause damage to non-target reef structures and substrates. In addition, disturbances caused by the pressure and acoustic effects of blasting are not easily anticipated and may inflict damage on individual coral colonies and other reef-dwelling fishes and invertebrates. These effects are described in subsequent sections of this report. Other indirect effects due to dredging and blasting include the displacement of fishes and invertebrates. These effects would probably be short-term. Finally, dredging may result in suspension of any fine carbonate materials that have settled on substrates or have been enclosed within reef structures ("powder pockets"). This re-suspension of sediments may result in temporary periods of increased turbidity within the area. Turbidity will likely affect the productivity and health of hermatypic corals, and deposition of suspended sediments on adjacent areas could cause the temporary displacement of fishes and invertebrates.

Delivery and deposition of dredged materials at the proposed seagrass compensation site (see below), the Virginia Key upland disposal site, or the offshore dredged material disposal site may have consequences for fish and wildlife resources. Dredge pipelines, equipment, and dredged materials themselves may incidentally impact sensitive habitats, such as dunes, mangroves, and seagrass beds. In marine habitats, increases in turbidity will likely result from deposition of materials.

6.1.6 Essential Fish Habitats

Essential Fish Habitats (EFH) present in the project area include seagrass beds, hardbottom, reefs, inshore softbottom habitats, the water column, and beds of the red alga genus *Laurencia* (SAFMC 1998b). With the exception of water column habitat and algae beds, anticipated loss of these habitats due to project implementation is quantified in Section 5.1. Every proposed component, except Component 4, will cause damage to EFH (Table 6). Decreases in EFH, particularly high-quality habitat and those designated as Habitat Areas of Particular Concern (HAPC), would affect populations of managed fish and invertebrate species. Section 3.2.5.3 addresses the various habitat affiliations of several managed fish and invertebrate species in southeast Florida.

The most obvious direct impact of the Recommended Plan on managed species in all habitats is the potential for mortality and/or injury of individuals through the dredging and/or blasting processes. Species in any and all of the project area's habitats are susceptible. Fishes and invertebrates are at risk at any life-history stage; eggs, larvae, juveniles, and even adults may be inadvertently killed, disabled, or undergo physiological stress, which may adversely affect behavior or health. Forms that are less motile, such as juvenile shrimp, are particularly vulnerable (they would be sucked into the dredge apparatus, or otherwise directly removed from their habitat).

Blasting will also have a direct impact on managed fish species residing in/migrating through the harbor and associated waterways. Previous studies (Corps 1996; Keevin and Hempen 1997; Young 1991) have addressed the impacts of blasting on fishes. Fishes with air bladders are particularly more susceptible to the effects of blasting than aquatic taxa without air bladders (*e.g.,* shrimp, crabs, etc.), which are more resistant to the impacts of blasting (Keevin and Hempen 1997). Fish species that are relatively small in size and/or exhibit territorial behavior, are most likely to impact during blasting.

Although dredge operations are likely to directly impact individuals of managed species in observable lethal and sublethal manners, dredging and blasting may have more subtle adverse effects. These subtle effects act on individuals, but may be perceived only at the population level. For example, dredging/blasting activities, particularly in linear corridors (such as Cut 3 and Fisherman's Channel) may interfere with migration patterns of species that require utilization of both inshore and offshore habitats through ontogeny. This is a particular concern for species that travel along shorelines and bulkheads. Therefore, dredging berths and littoral zone habitats is anticipated to have greater effects. These impacts may result in displacement of individuals or disjuncture in the life-cycles of managed species.

Impacts to the water column can have widespread effects on marine and estuarine species. Hence, it is recognized as EFH. The water column is a habitat used for foraging, spawning, and migration by both managed species and organisms consumed by managed species. Water quality concerns are of particular importance in the maintenance of this important habitat. During dredging in substrates comprising coarser materials and rock, water quality impacts are expected to be minimal. However, where silt and/or silty sand are to be dredged, water quality impacts are expected to be significant, and take several weeks/months after cessation of dredging activities to return to background levels. Re-suspended materials will interfere with the diversity and concentration of phytoplankton and zooplankton, and therefore affect foraging success and patterns of schooling fishes and other grazers that comprise prey for managed species. Recent efforts to quantify areal impacts of dredging incorporate only the waters directly above dredged substrates. However, due to the physical properties of water and the complex hydraulics operating within the harbor and channels, these efforts greatly underestimate the extent of negative effects of dredging.

The destruction of Essential Fish Habitat habitats, such as seagrass beds, inshore softbottom, mangroves, hardgrounds, and reefs result in the loss of substrates used by managed species for spawning, nursery, foraging, and migratory/temporary habitats. The most critical losses of EFH would be those areas additionally designated as Habitat Areas of Particular Concern (HAPC). Coastal inlets are HAPC for shrimps, red drum, and grouper. Inlets are important for these species that prefer estuarine, inshore habitats such as mangroves, seagrass beds, and mudflats. Medium- and high-profile reefs are also considered HAPC for grouper, and the hardbottom existing in 5 to 30 meters of depth off of Miami-Dade County is listed as HAPC for corals and coral reefs (SAFMC 1998a).

Significant losses to EFH-HAPC within the areas proposed for dredging include destruction of seagrass beds and coral reef. Seagrass beds provide important habitat, but seagrasses in the project area are even more important due to their proximity to reef and hardbottom habitats. Their function is intimately coupled with reefs to provide life-stage-specific habitat for certain managed species. Loss of these two habitats (reef and seagrass) will result in a loss of habitat critical in the spawning and early life-stages for species of the snapper-grouper complex, which is consists of 73 species that commonly use the inshore habitats for part of their life cycle. These include blue stripe grunts, French grunts, mahogany snapper, yellowtail snapper, and red grouper.

Seagrass beds are also intimately coupled with mangroves, such as at nearby Virginia Key. These mangrove areas serve a nursery for many managed species including pink shrimp, spiny lobster, and members of the snapper-grouper complex, many of which also rely on seagrass habitats at certain phases during ontogeny.

Impacts to populations of managed species will occur due to dredging softbottom habitats, including those that lack seagrasses. Dredging will remove benthic organisms used as prey by managed species and as a result may temporarily impact certain species, such as red drum, that forage largely on such taxa. Dredged habitats are anticipated to recover, in terms of benthic biodiversity and population density, within 2 years.

Populations recreationally and commercially important fish species may be affected by turbidity, which may alter the algae and plankton assemblages of the harbor, channels, and nearshore habitats. Entire food webs rely on specific types of algae and plankton. Their absence or decrease in concentration could alter primary consumer populations and cause a ripple effect throughout each trophic level in the food chain.

6.2 Threatened and Endangered Species

The Corps has determined that the proposed expansion and deepening of the Miami Harbor as described in the Recommended Plan "may affect, but is not likely to adversely affect" the endangered West Indian manatee, endangered American crocodile, endangered green sea turtle, threatened loggerhead sea turtle, endangered Kemp's ridley, endangered hawkskbill sea turtle, and endangered leatherback sea turtle, endangered smalltooth sawfish, and endangered whale species which are known to occur along the Atlantic Coast. Possible adverse effects to these species during construction include injury, mortality, or harassment and may affect the life history of these species as a result of the loss or modification of habitats via dredging and/or blasting associated with construction. In addition, possible adverse effects to critical habitat designated for the West Indian manatee and Johnson's seagrass are likely as a result of the permanent removal of substrate during the widening Fishermen's channel and the Fisher Island turning basin. Indirect impacts would include effects to nearby habitats or species within nearby areas either during dredging, spoil deposition, and/or blasting activities as a result of turbidity and/or sedimentation.

6.2.1 West Indian Manatee

The Corps has determined that the proposed expansion and deepening of Miami Harbor "may affect, but is not likely to adversely affect"the manatee since the *Standard Manatee Protection Conditions* and a comprehensive blasting plan will be incorporated in the project design to minimize possible adverse effects of the project on listed species within the action area. The Corps anticipates that three blasts per-day over a period of 1,553 days will be the maximum blast days required, if all the rock material in the channels will require blasting and one blast barge is utilized. In the public hearing on May 6, 2003, the Corps further assured those in attendance that “take” of a listed marine mammal or reptile, as defined by the ESA, will not occur as a result of blasting activities at the Port of Miami.

In addition, approximately 6.3 acres of seagrass, manatee foraging habitat, within the boundaries of both State and federally designated Critical Habitat for the manatee will be adversely affected as a result of the construction activities within Fishermen’s Channel. The Corps has proposed to compensate for seagrass at a 1:1 mitigation ratio. However, the Service believes that this mitigation ratio is insufficient and recommends a 3:1 mitigation ratio (18.9 acres) to replace the function and value of manatee foraging habitat, as well as, to compensate for the risk associated with seagrass restoration projects. Provided that adequate mitigation is conducted that incorporates the temporal loss of function and risk of success, which equates to a 2.9:1 ratio, the Service believes the construction activities associated with the proposed project would not likely result in an adverse affect to manatee Critical Habitat.

6.2.2 American Crocodile

The Service concurs with the Corps determination that the proposed project “may effect, but is not likely to adversely affect” adults, hatchlings, and/or juveniles of the American crocodile during dredge spoil disposal operations on Virginia Key and/or blasting activities. Since the implementation of protection measures designated to minimize possible adverse effects to frequently observed listed species such as the manatee and sea turtles, these provisions will include the American crocodile.

6.2.3 Sea Turtles

In general, beaches immediately adjacent to proposed dredging sites support little sea turtle nesting activity. However, other resources comprise important habitats for turtles. Removal of sections of hardbottom, reef, and seagrass habitats will eliminate potential foraging habitat for juvenile and adult turtles and refugia for hatchlings. Also, dredge activities and associated disturbances (noise, lights, etc.) offshore may interrupt the movement of turtles swimming toward or away from nesting beaches to the north or south. Specifically, the highest potential impact to sea turtles may result from the use of explosives to break/dislodge rock substrates in offshore channels. Threshold lethal pressures for sea turtles are probably similar to those of marine mammals (U.S. Department of the Navy, 1998, as cited in Corps 2000a). Therefore, turtles in the immediate vicinity of any detonation site would likely be killed, and individuals existing within 400-600 feet of the blast would likely suffer injury. Additional information is provided in Effects of Blasting below.

Another possible element of the action that may affect sea turtles is the presence of light and/or noise from construction/dredging vessels anchored offshore. These factors may interrupt the movement of adult, nesting, female turtles swimming toward or away from nesting beaches, and may cause disorientation of hatchlings following emergence. However, since the port is an active facility, offshore lighting is not an unusual feature of the area, and should not appreciably change the ambient conditions of nesting areas in the vicinity of the action. In addition, all construction/dredging vessels are required to adhere to best management practices, such as preventing lights from exposure to shore through use of shields. Therefore, no adverse indirect impacts due to dredging operations are anticipated for the proposed action.

6.2.4 Johnson's seagrass

Adverse effects to beds of Johnson's seagrass beds are not anticipated by project actions, as populations of the seagrass has not been observed in the action area or the vicinity of the action area. Portions of the action area where deepening will occur (federally authorized channels) are excluded from designated critical habitat, and therefore impacts to critical habitat will not occur. However, where widening will occur in the Biscayne Bay (Fisherman's Channel and Fisher Island Turning Basin), substrate that fall within critical habitats will be removed.

The Corps states that the substrate to be removed are not amenable to colonization by Johnson's seagrass because they are currently occupied by beds of other species of seagrass; a "colonizing" species such as Johnson's seagrass would not be able to establish a population due to interspecific competition. Therefore, the Corps concludes that the proposed project is not likely to adversely modify designated critical habitat of Johnson's seagrass.

6.2.5 Smalltooth Sawfish

Although seagrass and other softbottom habitats will be removed, the Corps does not anticipate that the proposed project will have any indirect effects on smalltooth sawfish in the vicinity of the action area. These habitats may be utilized by the species. However, loss of seagrass habitats is relatively small with respect to nearby resources, and will be compensated through mitigative measures. Nearshore softbottom areas are also plentiful in and near the action area, and impacts to them would not limit resource use by sawfish, especially since population density of individuals in the area is extremely low, or nil.

6.2.6 Whales and Dolphins

Adverse effects to species of marine mammals, particularly resident populations of dolphins within Biscayne Bay, may occur during blasting activities. These effects are described below.

6.2.7 Effects of Blasting

The highest potential for direct impacts to threatened and endangered marine mammal species may result from the use of explosives to break/dislodge rock substrates in Fisherman's Channel, where manatees are known to congregate during winter months. Both the pressure and noise associated with blasting can injure marine mammals. Noise and pressure effects on manatees have not been well documented, however, it is assumed that manatees will be impacted similar to dolphins. For the current project, there is a risk that both taxa may be affected during the proposed maximum of three blasts per day over a period of 1,550 days.

Direct impacts on marine mammals due to dredging/blasting and construction activities in the project area include alteration of behavior and autecology. For example, daily movements and/or seasonal migrations of manatees and dolphins may be impeded or altered. In addition, marine mammals may alter their behavior or sustain minor physical injury from detonation of blasts outside the 600-foot safety zone. Although incidental take would not result from sound/noise at this distance, disturbances of this nature (alteration of behavior/movements) may be considered harassment under MMPA and ESA. These are special concerns for resident populations of manatees and bottlenose dolphins.

The use of blasting to break apart substrates in offshore areas, particularly at the outermost reef, is strongly discouraged. Effects of blasting on managed/protected reef and pelagic species would be detrimental (at the individual and population levels), and it is likely that non-target reef structures will be damaged, and there will be direct mortality of fishes up to 140 feet away from each charge (Keevin and Hempen 1997) and turtles and marine mammals up to 400 feet away from each charge. Conducting a test blast with subsequent biological monitoring would help the Service appraise what damages would be to local fish populations, and allow for exploration of mitigative measures that may be employed to decrease impacts. Mortality of sea turtles and marine mammals can be generally eliminated by ensuring that none pass within 600 feet of the discharge.

Utilizing data from rock-contained blasts such as those at Atlantic Dry Dock North Carolina, the Corps has been able to estimate potential effects on protected species. These data can be correlated to the data from the EPA concerning blasting impacts to marine mammals. The EPA data indicates that impacts from explosives can produce lethal and non-lethal injury as well as incidental harassment. The pressure wave from the blast is the most causative factor in injuries because it affects the air cavities in the lungs & intestines. The extent of lethal effects are proportional to the animal's mass, *i.e.*, the smaller the animal, the more lethal the effects; therefore all data are based on the lowest possible affected mammal weight (infant dolphin). Non-lethal injuries include tympanic membrane (TM) rupture; however, given that dolphin and manatee behavior rely heavily on sound, the non-lethal nature of such an injury is questionable in the long-term. For that reason, it is important to use a limit where no non-lethal (TM) damage occurs. Based on the EPA test data, the level of pressure impulse where no lethal and no non-lethal injuries occur is reported to be 5 psi-msec.

The degradation of the pressure wave
George Young (1991) noted the following limitations of the cube root method:

> *Doubling the weight of an explosive charge does not double the effects. Phenomena at a distance, such as the direct shock wave, scale according to the cube root of the charge weight. For example, if the peak pressure in the underwater shock wave from a 1-pound explosion is 1000 pounds per square inch at a distance of 15 feet, it is necessary to increase the charge weight to approximately 8 pounds in order to double the peak pressure at the same distance. (The cube root of eight is two.)*

Effects on marine life are usually caused by the shock wave. At close-in distances, cube root scaling is generally valid. For example, the range at which lobster have 90 percent survivability is 86 feet from a 100-pound charge and double that range (172 feet) from an 800-pound charge.

As the wave travels through the water, it reflects repeatedly from the surface and seabed and loses energy becoming a relatively weak pressure pulse. At distances of a few miles, it resembles a brief acoustic signal. Therefore, shock wave effects at a distance may not follow simple cube root scaling but may decline at a faster rate. For example, the survival of swim bladder fish does not obey cube root scaling because it depends on the interaction of both the direct and reflected shock waves. In some cases, cube root scaling may be used to provide an upper limit in the absence of data for a specific effect.

More recent studies by Finneran *et. al*. (2000), showing that temporary and permanent auditory threshold shifts in marine mammals were used to evaluate explosion impacts. Due to the fact that marine mammals are highly acoustic, such impacts in behavior should be taken into account when assessing harmful impacts. While many of these impacts are not lethal and this study has shown that the impacts tend not to be cumulative, significant changes in behavior could constitute a "take" under the MMPA.

The effects of blasting on sea turtles and the smalltooth sawfish are described as follows. There have been studies that demonstrate that sea turtles are killed and injured by underwater explosions (Keevin and Hempen 1997). Sea turtles with untreated internal injuries would have increased vulnerability to predators and disease. Nervous system damage was cited as a possible impact to sea turtles caused by blasting (U.S. Department of Navy 1998). Damage of the nervous system could kill sea turtles through disorientation and subsequent drowning. The Navy's review of previous studies suggested that rigid masses such as bone (or carapace and plastron) could protect tissues beneath them; however, there are no observations available to determine whether the turtle shells would indeed afford such protection. Studies conducted by Klima *et al*., (1988) evaluated blasts of only approximately 42 pounds on sea turtles (four ridleys and four loggerheads) placed in surface cages at varying distances from the explosion. Christian and Gaspin's (1974) estimates of safety zones for swimmers found that, beyond a cavitation area, waves reflected off a surface have reduced pressure pulses; therefore, an animal at shallow depths would be exposed to a reduced impulse. This finding, which considered only very small explosive weights, implies that the turtles in the Klima *et al*. (1988) study would be under reduced effects of the shock wave. Despite this possible lowered level of impact, five of eight turtles were rendered unconscious at distances of 229 to 915 meters from the detonation site. Unconscious sea turtles that are not detected, removed and rehabilitated likely have low survival rates. Such results would not have resulted given blast operations confined within rock substrates rather than unconfined blasts. The proposed action will use confined blasts, which will significantly reduce the area around the discharge where injury or death may occur. The Corps assumes that tolerance of turtles to blast overpressures is approximately equal to that of marine mammals (Department of the Navy 1998); *i.e.*, death would not occur to individuals farther than 400 feet from a confined blast (Konya 2001).

Review of ichthyological information and test blast data indicate that fishes with swim bladders are more susceptible to damage from blasts, and some less-tolerant individuals may be killed within 140 feet of a confined blast (Corps 2000a). Sawfishes, as chondrichthyans, do not have air bladders, and, therefore, they would be more tolerant of blast overpressures closer to the discharge, possibly even within 70 feet of a blast.

Due to conservation safeguards that will be incorporated into the project design, the Corps does not anticipate adverse effects to either sea turtles or sawfish are anticipated. To avoid or minimize any possibility of direct impacts, blasting is not anticipated to occur offshore where mature females may be migrating to nesting areas in the county. Risk to sawfish will likely be minimal as there are no historic or recent records of the species in the project area.

7.0 SERVICE'S MITIGATION POLICY

Potential impacts of the proposed Port expansion project include the following habitat: unconsolidated benthic habitat, seagrasses, nearshore hardbottom, coral reef, rock/rubble, and channel wall. Impacts may include removal as a result of dredging and/or blasting activities, burial from actual fill placement at mitigation and offshore disposal sites, burial and suffocation from suspension and settling generated from dredging and/or blasting activities, dredged material placement at mitigation site, and damage during construction activities.

In developing the Service's Mitigation Policy (Federal Register 46 (15), Pg. 7656), the definition of mitigation contained in the Council on Environmental Quality's National Environmental Policy Act regulations (40 CFR 1508.20[a-e]) was used. This definition recognizes mitigation as a stepwise process that incorporates both careful project planning and compensation for unavoidable losses and represents the desirable sequence of steps in the mitigation planning process. Initially, project planning should attempt to ensure that adverse effects to fish and wildlife resources are avoided or minimized as much as possible. In many cases, however, the prospect of unavoidable adverse effects will remain in spite of the best planning efforts. In those instances, compensation for unavoidable adverse effects is the last step to be considered and should be used only after the other steps have been exhausted.

The Service's Mitigation Policy focuses on the mitigation of fish and wildlife habitat values, and it recognizes that not all habitats are equal. Thus, four resource categories, denoting habitat type of varying importance from a fish and wildlife resource perspective, are used to ensure that the mitigation planning goal will be consistent with the importance of the fish and wildlife resources involved. These categories are based on the habitat's value for the fish and wildlife species in the project area (evaluation species) and the habitat's scarcity on a national, regional or local basis. Resource Category l is of the highest value and Resource Category 4, the lowest. Mitigation goals are established for habitats in each resource category.

The mitigation goal for Resource Category 1 habitats is no loss of habitat value since these unique areas cannot be replaced. The goal for Resource Category 2 habitats is no net loss of in-kind habitat value. Thus, a habitat in this category can be replaced only by the same type of habitat (*i.e.*, in-kind mitigation). The mitigation goal for Resource Category 3 habitats is no net loss of overall habitat value. In-kind replacement of these habitats is preferred, but limited substitution of different types of habitat (out-of-kind mitigation) perceived to be of equal or greater value to replace the lost habitat value may be acceptable. The mitigation goal for Resource Category 4 habitats (considered to be of marginal value) is to avoid or minimize losses, and compensation is generally not required.

Priority habitats in the project area are seagrasses, nearshore hardbottom, and coral reef. These habitats are considered by the Service to be in Resource Category 2, and no net loss of in-kind habitat value is recommended. However, we consider any significant colonies of hard (stony) coral in this area to be Resource Category 1. Research suggests that two species of brain and star

coral grow at a rate of approximately 0.5 centimeter per year (Dodge 1987). Based on this information, we estimate it would take these corals, and likely other hard coral species, at least 100 years to reach 1 meter in diameter.

7.1 Evaluation of Proposed Mitigation

As previously stated, the Corps estimates that a total of 418.2 acres of aquatic resources, including seagrass communities, unvegetated softbottom, hardbottom, and coral reef habitat will likely be adversely affected as a result of construction activities associated with the expansion of Miami Harbor. Specifically, 6.3 acres of seagrass; 236.4 acres of unconsolidated/ unvegetated benthic habitat (softbottom); 123.5 acres of rock/rubble bottom; 31.4 acres of low relief hardbottom; and 20.7 acres of high relief hardbottom and coral reef habitat may be adversely affected. However, many of these habitats occur in areas that were impacted during previous dredging activities within Miami Harbor. Therefore, the total impact to habitats not previously dredged include: 6.3 acres of seagrass, 0.6 acre of low-relief hardbottom, 2.7 acres of high-relief coral reef, 3 acres of rock/rubble, and 23.3 acres of unconsolidated/unvegetated benthic habitat.

The Corps states that a 15.9 acre-mitigation reef was constructed as compensation for hardbottom impacts associated with the 1991 dredging event; therefore, mitigation is proposed for new impacts only. As compensation for the impacts to habitats that were not dredged previously, the Corps has proposed the following: (1) mitigate for the removal of 6.3 acres of seagrass at a ratio of 1:1 through the restoration of a 18.6-acre historic dredged borrow site in northern Biscayne Bay, where the restored acres provided in excess of the 1:1 mitigation ratio would serve as a compensation "bank" for seagrass impacts associated with future Port projects; (2) mitigate for the removal of 2.7 acres of high-relief coral reef habitat at a ratio of 2:1 through the creation of 5.3 acres of high-complexity, high-relief artificial reef habitat; and (3) mitigate for the 0.6 acre of impact to low-relief hardbottom habitat at a ratio of 1.3:1 through the creation of 0.8 acre of low-complexity, low-relief artificial hardbottom habitat. In addition, the Corps has not proposed compensation for the removal of the biotic communities, such as soft corals, sponges, and hard corals, which have colonized within the existing channel walls since the last dredging event in 1991.

The two types of mitigation reefs to be constructed, high-relief, high-complexity (HRHC) and low-relief, low-complexity (LRLC) reefs are illustrated in Figure 10. The HRHC relief will range in profile from 3 to 6 feet, whereas LRLC will range from 1 to 2 feet. Limestone rock excavated from the channel bed and expansion area will be used in reef construction. If necessary, supplemental, quarried limestone will also be used.

Rock/rubble-based habitats and softbottom marine habitats that lack seagrass are not proposed for mitigation, since the Corps considered that this habitat type will remain after construction and will re-colonize rapidly after construction.

7.1.1 Seagrass

The Corps proposes to compensate for the impacts to 6.3 acres of seagrass habitat at a 1:1 mitigation ratio through restoration of a borrow area in Northern Biscayne Bay. Specifically, the Corps proposes to fill an 18.6-acre borrow area located approximately 1 mile north of the project area, which was created during the construction of the Julia Tuttle Causeway approximately 40 years ago (Figure 8). In addition, any excess seagrass habitat restored as part of the filling the dredged holes with suitable dredged material would be banked by the Port of Miami for future use.

Overall, the Service supports the proposed seagrass mitigation site selected by the Corps. However, the Service recommends that for each acre of seagrasses that is impacted as a result of widening Fishermen's Channel and the Fisher Island Turning Basin, 3 acres be created or restored (3:1 ratio). This includes the impacts during dredging (0.34 acre), as well as the impacts to 6.0 acres adjacent seagrass beds during equilibration of the side-slope ("sloughing") which is reasonably certain to occur based on the calculation of impacts related to the unauthorized seagrass dredging south of Fisherman's Channel in the 1991. The Service considers side-slope sloughing, which is expected to occur within 50 to 70 feet of the channel as a direct impact. As previously stated, the Service believes the restoration of 18.9 acres of seagrass would compensate for the 6.3 acres of seagrass impacted during the construction of Components 3 and 5.

The Corps anticipates that the proposed seagrass mitigation site located north of the Julia Tuttle Causeway will be naturally colonized by seagrass since ample seed source is available from adjacent seagrass beds. The Corps states that further site evaluation will be conducted (including seagrass surveys, bathymetric profiles within and adjacent to each area, the collection and analysis of sediment samples, measurement of ambient PAR and TSS levels) at the site prior to final approval. Dredged material will either be hauled or pumped to the selected borrow area(s) based on engineering analysis, cost and recipient site conditions. It is anticipated that ambient depths will range from minus 2 feet to minus 6 feet MSL in the restored areas following restoration and that seagrass recruitment will likely occur within 3 years by *H. wrightii* and

H. decipiens, both of which likely occur within the shallow flats adjacent to these sites. Other species including *T. testudinum* and *S. filiforme* may colonize the site, but generally only after occupation by the early colonizing species previously cited, which may be at least10 years after construction. Furthermore, the Corps states that in the event that natural recruitment is not observed within 12 months following excavation, methods to plant seagrass donor material will be initiated. Planting methods will be developed following guidance by Fonseca *et al* (1998) and subject to peer review by NMFS and the Service. Detailed plans and specifications for the seagrass creation will be prepared and provided for agency review and comments prior to construction.

To support the Corps' proposed 1:1 mitigation ratio and to validate their determination that the proposed seagrass mitigation has a high probability of success, two examples of "successful" Biscayne Bay seagrass restoration projects were described in the Miami Harbor Draft EIS. However, those projects were much smaller in scale (less than 5 acres) as compared to the proposed mitigation project, a major causeway was not located adjacent to the example sites, natural seagrass beds entirely surrounded the restoration sites (unlike the proposed mitigation site), and monitoring plans were not initiated at either restoration site; therefore, the "success" of the projects was not documented. The Service acknowledges that the examples do provide adequate information for the Service to support the proposed mitigation technique and location. However, they lack the appropriate documentation (*e.g.*, monitoring reports) to support the assumption that the proposed mitigation project: (1) will result in seagrass habitat that will be of higher value than what was impacted; (2) is without risk and has a high probability of success; and (3) additional acreage to address temporal loss of function.

The Service maintains its position that the mitigation ratio should include a 1:1 ratio for habitat replacement, plus additional acreage to replace the function and value of seagrass habitat, as well as, to compensate for the risk associated with seagrass restoration projects. Therefore, the Service recommends that a 3:1 mitigation ratio (18.9 acres) would be more appropriate to compensate for temporal seagrass loss and risk of success associated with seagrass mitigation. The Service bases its mitigation ratio recommendation on the following: (1) natural colonization at the mitigation site will not provide immediate replacement of the impacted habitat since 3 or more years may be required to establish a viable "pioneer" seagrass community, which typically includes shoal grass and paddle grass; (2) a large portion of the anticipated impacts to seagrass will involve turtle grass, which is considered a climax seagrass community; (3) turtle grass often requires at least 10 years to recover naturally; and (4) replanting turtle grass is often ineffective (Fonesca *et al.* 1998). Furthermore, seagrass restoration projects that were considered successful rarely achieved 100 percent recovery due to a number of factors that may limit the restoration success, such as inadequate site preparation, bioturbation, storms and other natural effects.

However as stated above, the Service supports the Corps' decision that the proposed seagrass mitigation site most closely matches the selection criteria as recommended in Fonesca *et al.* 1998. Though the site does not contain the full 18.9 acres recommended for seagrass mitigation, the Service believes that if the entire 18.6 acre site is utilized for seagrass restoration then a 2.9:1 mitigation ratio would be sufficient compensation for 6.3 acres of seagrass impacts associated with the current project. In the Miami Harbor Draft EIS, the Corps states that success criteria will be established and a seagrass monitoring plan will be followed. The Service recommends that a minimum of 5 years of monitoring should be conducted to ensure recruitment of seagrasses at the mitigation site.

7.1.2 Low-Relief Hardbottom and Coral Reef

As proposed, the project involves the direct impacts to approximately 52.07 acres of high- and low-relief reef and other hardbottom habitat of variable quality and composition (including an estimated 2.67 acres of channel wall habitat). Approximately 3.3 acres (0.6 ac of low-relief, and 2.7 acres of high-relief) of impacts will occur to previously non-dredged habitat. The Corps has not proposed mitigation for direct impacts to previously dredged high- and low- relief hardbottom habitat and rock/rubble habitat within the project footprint.

The Corps has proposed the construction of approximately 5.4 acres of high-complexity, high-relief reef (HCHR) and approximately 0.8 acres of low-complexity, low-relief (LCLR) hardbottom habitat. The proposed mitigation values were determined through the NOAA's Habitat Equivalency Analyses (HEA) (NOAA 2000b) (Appendix B). As a result, the Corps has proposed mitigation at a 2:1 ratio (2 acres of creation for each acre of impact) for new impacts to high-relief reef habitat, and a 1.3:1 ratio for low-relief reef habitat. The proposed locations for mitigation reefs are previously permitted, Miami-Dade County artificial reef sites (Figure 9). The proposed mitigation will include direct replacement for habitat type, to reflect the ecological differences between the reef types impacted. The Service concurs with the proposed mitigation ratios.

The Corps has not proposed mitigation for impacts to previously impacted rock/rubble or high- and low- relief hardbottom habitat located within the existing channel bed and wall. The Service concurs with the Corps that additional mitigation is not required for impacts to rock/rubble habitat since similar substrate will remain after construction and colonization will likely occur fairly rapidly. The Service conducted an analysis to determine the temporal loss of function of the rock/rubble habitat to be impacted. Since colonization of the remaining habitat will likely occur within 2 to 4 years, the temporal loss of function was found to be insignificant; therefore, additional mitigation acreage was not recommended.

The Corps contends that mitigation is not necessary for impacts to previously impacted hardbottom habitat since mitigation was provided for similar impacts. Specific information regarding the mitigation reef (*e.g.*, acreage, location, monitoring reports, acres of habitat impacted, etc.) was requested by during several coordination meetings with the Corps; however, the information was difficult to obtain. In an email dated May 1, 2003, the Corps provided photos and stated that a 15.9 acre-mitigation reef was constructed in 1996 as compensation for impacts associated with the 1991 Miami Harbor dredging project. The Service contacted DERM on May 29, 2003, for additional information regarding the mitigation reef. According to DERM, the 15.9 mitigation reef was constructed as compensation for high-relief coral reef impacts outside of the channel as a result of anchor damage caused by the dredged. Specifics regarding the exact extent of the damage were not available. Therefore, mitigation has not been provided for hardbottom impacts associated with previous dredging projects in Miami Harbor.

The Service recommends that additional mitigation is provided to compensate for the temporal loss of function as a result of the removal of epibenthic organisms that have colonized previously dredged high-and low-relief hardbottom habitat, including the channel walls, in the past 12 years since the last dredging event. The channel walls are oriented vertically up to 3 feet back from edges (on a horizontal plane) but provide refugia for a large number of federally managed fish and invertebrate species, therefore, these areas are considered low-relief hardbottom habitat. Table 7 below indicates the total acreage of impact to high-and low-relief hardbottom habitats, including the 2.67 acres of channel wall impacts.

Table 7: Acreage of Hardbottom Impacts

<table>
<tr><th>Habitat type</th><th>Low-relief hardbottom (previously dredged acres)</th><th>High-relief hardbottom (previously dredged acres)</th><th>Low-relief hardbottom (new impacts acres)</th><th>High-relief hardbottom (new impacts acres)</th></tr>
<tr><td>Proposed impact acreage</td><td>28.1</td><td>18.0</td><td>0.6</td><td>2.7</td></tr>
<tr><td rowspan="2">Proposed mitigation (acres)</td><td rowspan="2">0</td><td rowspan="2">0</td><td>0.8</td><td>5.4</td></tr>
<tr><td colspan="2">Total= 6.2 acres</td></tr>
<tr><td rowspan="2">HB Impact Acres, including sidewall impacts</td><td>30.7
(incl. 2.6 acres side wall impacts)</td><td>18.0</td><td>0.8</td><td>5.4</td></tr>
<tr><td colspan="2">Total =48.7 acres</td><td colspan="2">Total= 6.2 acres</td></tr>
</table>

The Service conducted a Mitigation Bank Review Team (MBRT) analysis to determine the temporal loss mitigation acreage for impacts to 48.7 acres of previously impacted hardbottom habitat. Using a temporal loss factor of 12 years for full functional habitat recovery, the creation of 64.64 acres (58.44 acres for temporal loss of previously mitigated hardbottom plus 6.2 acres for new hardbottom impacts) artificial reef would meet the hardbottom mitigation requirements (Table C-1). However, approximately 48.7 acres of similar habitat base (high- and low- relief hardbottom) will remain in the channel after dredging that will likely be re-colonized and/or utilized by similar affected biotic communities. Thereby, the remaining 48.7 channel bottom acres could then be subtracted from the 58.44 acres (MBRT temporal loss mitigation acres), which would result in a deficit of 9.74 acres to be fulfilled by “outside-of-channel footprint” hardbottom artificial reef creation. Therefore, if 9.74 acres of outside-of-channel footprint hardbottom is added to 6.2 acres of new-impact hardbottom mitigation, the Service’s final recommended hardbottom mitigation is 15.94 acres (Table 8).

Table 8: Hardbottom Mitigation Recommendations

<table>
<tr><th></th><th>Proposed impact acreage</th><th colspan="2">Proposed mitigation (acres)</th><th>FWCA Report Impact Calculation (acres)</th><th colspan="2">Service’s Hardbottom Mitigation Recommendations (acres)</th></tr>
<tr><td>Low-relief hardbottom (previously dredged)</td><td>28.1</td><td colspan="2">0</td><td>30.7 (incl. sidewall impacts 0</td><td rowspan="2">58.44 (MBRT result)</td><td><u>Post-dredging channel footprint</u> (remaining habitat)</td></tr>
<tr><td>High-relief hardbottom (previously dredged)</td><td>18.0</td><td colspan="2">0</td><td>0</td><td rowspan="2">48.7 acres Total</td></tr>
<tr><td>Low-relief hardbottom (new impacts)</td><td>0.6</td><td>0.8</td><td>6.2</td><td>0.6</td><td>6.2</td></tr>
</table>

High-relief hardbottom **(new impacts)**	2.7	5.4		2.7		Total hardbottom mitigation recommended **6.2 +9.74= 15.94 Acres**

8.0 RECOMMENDATIONS

The Service offers the following recommendations regarding the proposed mitigation and monitoring:

(1) As compensation for the loss of 6.3 acres of seagrass within designated manatee Critical Habitat and the Bill Sadowski State Critical Wildlife Area, the Service recommends that 18.6 acres of seagrass mitigation is provided at a 2.9:1 ratio. The Service maintains its position that seagrass mitigation proposed at a 1:1 ratio is insufficient.

(2) Detailed seagrass surveys to locate and quantify the existing seagrass coverage within the proposed seagrass mitigation site should be conducted. Since the Service maintains that the proposed seagrass mitigation site should be dedicated in its entirety as compensation for seagrass impacts associated with the proposed project, additional mitigation acreage for unavoidable impacts to seagrass within the proposed seagrass mitigation site should be provided.

(3) The project monitoring plan should include surveys during and after construction for potential impacts as a result of dredge anchors and cables. If impacts to hardbottom or seagrass habitat are documented, mitigation should be provided at ratios previously determined for "new" impacts.

In the Draft FWCA report, the Service provided recommendations to the Corps to avoid and minimize impacts to fish and wildlife resources. The Corps provided the following responses to our recommendations.

(1) As compensation for direct impacts to hardbottom habitat, as well as temporal loss of function to hardbottom habitat with the previously dredged channels, the Service recommends that 19.3 acres (now reduced to 15.94 acres) of in-kind mitigation is provided.

Corps response: The Corps rejects the recommendation to provide compensation for impacts within the previously dredged channel since mitigation has been provided.

The information provided to the Service by the Corps regarding the mitigation reef indicated that a 15.9 acre mitigation reef was constructed as compensation related to hardbottom impacts within the channel as a result of the 1991 harbor dredging event, but details regarding the type or extent of impact were not provided. Based on information provided by DERM, the mitigation reef was constructed as compensation for anchor and cable impacts. Therefore, the Service maintains its position that in-kind mitigation in the amount of 15.94 acres should be provided as compensation for the direct impacts to hardbottom habitat in the project area, as well as, the temporal loss of function of the hardbottom habitat located within the previously dredged channels.

(2) Remove and relocate all brain and star coral larger than 6 inches within the 2.7 acres of high-relief coral reef impact area, which has not been previously dredged, by authorized and experienced personnel to appropriate areas within the vicinity of the original location and include monitoring provisions. However, in our January 14, 2003, letter to the Corps, the Service revised this recommendation as follows: Remove and relocate all hard coral colonies larger than 6 inches in diameter within the project footprint, including the previously dredged areas by experienced personnel through established methods to suitable nearby hardbottom substrate. Biological monitoring should be instituted.

Corps Response: The Corps stated that the recommendation, as amended, is not feasible due to the costs associated with surveying and mapping 49 acres of hardbottom communities in the project area. However, the Corps will discuss the recommendation with the non-Federal sponsor to consider the relocation of hard corals within the 3.1 acres of reef that has not been previously impacted.

The Service strongly recommends the removal and relocation of all stony corals larger than 6 inches specifically within the entrance channel and Fisher Island turning basin. Significant stony corals, such as a brain coral greater than 2 feet in diameter, were observed in notable locations within the entrance channel and Fisher Island turning basin by the Service, NMFS, and the Corp's consultant during our site visits to the project area. Since video surveys of the channels in Miami Harbor have been conducted, the Service recommends review of the existing video data to select specific areas to survey for detailed evaluation.

The Service acknowledges the Corps' funding constraints during the Feasibility stage of project planning; however, the detailed hard coral surveys within the channel can be conducted during the Preconstruction Engineering and Design phase of the project, if Congress approves the appropriations for the project under Water Resources Development Act.

If the Corps maintains their objection to hard coral removal and relocation, then the Service recommends that the HEA and MBRT analysis are recalculated to address the significant increase of recovery time for those species, particularly in the proposed entrance channel expansion areas, as well as the portions of the entrance channel and Fisher Island turning basin that were last dredged in 1968. Therefore, the mitigation acreage for hardbottom impacts should increase to reflect the increased temporal loss of function, since the present assumption of 12 year factor will no longer be valid, even at a coral growth rate of greater than 1 centimeter per year.

(3) The Service should be provided with final details for disposal methods, land-use history and current habitat data for areas adjacent to the upland disposal site on Virginia Key and resource information for areas surrounding seagrass mitigation sites (which will receive some spoil material). If necessary, Service staff may visit the sites to ensure that there are no anticipated adverse impacts to jurisdictional wetlands, surface waters, or protected species. If the upland site is judged adequate for disposal based on lack of effects to fish and wildlife, especially the threatened American crocodile, the Service recommends that discarded materials be contained in a diked area and that Best Management Practices are followed in order to prevent erosion and runoff following storm events and dewatering. Plans should include turbidity containment devices at the dewatering outfall.

The Service requests participation in the development of a water quality monitoring program to determine if turbidity levels (and contaminant levels, if relevant) may be adversely affecting fish and wildlife resources and/or habitats in or adjacent to the project area. The Service recommends water quality monitoring to occur at regular intervals, particularly in reef and seagrass communities, during dredging activities to ensure compliance with State of Florida water quality requirements. In addition, the Service requests copies of all water quality data resulting from sampling activities both during and after dredge operations. Finally, a contingency plan to halt operations must be in place should suspended sediment concentrations exceed acceptable levels. A 150-meter allowable mixing zone near the cutterhead dredge would be exempt from data collection for monitoring purposes.
Corps response: If the upland disposal site will be used for material disposal, details of that disposal site can be provided to the Service if it is determined that any resources under the Services jurisdiction will be impacted.

(4) A monitoring plan to evaluate the extent of the impact to hardbottom habitat should be submitted to the Service and NMFS, and all data/reports pertaining to recovery of coral and sponge communities on channel walls must be submitted to the Service in Vero Beach office and the Miami NMFS office. The monitoring plan should include survey methodology to determine the extent of the direct and indirect effects of the construction activities on the channel walls and previously dredged channel bottom associated with the Miami Harbor expansion. In addition, hardbottom reef sedimentation monitoring should be instituted during dredging regardless of the water column exemption for turbidity monitoring within the stated 150-foot mixing zone. Schedule for submittal, monitoring parameters, and methods, will correspond with artificial reef monitoring.

Corps Response: When a detailed mitigation plan is completed, this will be submitted to the resource agencies, including the Service, if it is determined that any resources under the Service's jurisdiction. The Corps will adhere to the monitoring requirements of the DEP's Water Quality Certificate, when issued and accepted.

(5) Implement an effective watch program during blasting that is designed to delay detonation until the designated safety zone is clear of marine mammals and/or sea turtles to minimize possible adverse effects to listed species during blasting activities, as described in the following section. The most effective watch program consists of the primary survey observer based in an aircraft with secondary observers on boats, bridges, and/or land with sufficient communication among all observers and the demolition contractor.

Corps Response: As stated in the Corps' Draft EIS and Biological Assessment submitted to the Service, the Corps will instigate an effective watch program to be initiated during blasting activities during port construction that will include a safety zone to ensure protection of listed species in the action area.

(6) During the coordination meetings, troubleshoot for potential problems such as radio contact failure among observers and/or the blasting subcontractor, poor weather or visibility issues, etc., and develop a contingency plan to resolve the issues.

Corps Response: A coordination meeting will be held between the parties involved in the construction and observations to address these potential issues.

(7) Schedule construction activities (blasting and dredging) outside of the winter season, November through March, when manatees are more dispersed.

Corps Response: The Corps has established a manatee and protected species protection plan that prohibits blasting when any of those animals are within a certain radius of the blasting activities. During the winter months, when manatee densities may be higher near the project area, the Corps may not be able to blast as often as during the summer months. The Corps will not blast when manatee or other protected species, enter the no blast zone. Since the standard manatee protection techniques, which were developed in conjunction with the Service, will be implemented, the Corps believes that limiting dredging seasonally is unnecessary.

To further minimize possible adverse affects of blasting on the manatee, the Service maintains its recommendation to limit blasting activities to outside of the winter season.

(8) The Service recommends decreasing the impact area (seagrass, hardbottom, and sandy bottom), as much as possible by narrowing the channel width as much as is practicable. Likewise, impacts to reefs at the east end of the entrance channel should also be reduced as much as is practicable.

Corps response: The Corps has minimized the width of the channels as much as vessel safety allows through consultation and vessel simulation with the Port Harbor Pilots as well as the Coast Guard.

(9) Since larger and less maneuverable ships will be utilizing Miami Harbor, there may be an increased need for use of tugboats to position vessels. Therefore, the Service recommends that tugs be required to have kort nozzles or ducted propellers, and that operators are sure that no manatees are behind tugs when backing.

Corps response: The Corps states that it has no jurisdictional authority to implement this recommendation.

The Service recommends that the non-Federal sponsor consider this recommendation to minimize the potential effects of an increase in the number of tugs and tug activity that will be required to accommodate Super Post-Panamax vessels.

(10) Minimize possible adverse effects to nesting sea turtles and hatchlings by reducing or redirecting the lighting on offshore equipment and/or vessels.

Corps response: The NMFS biological opinion, which will address possible adverse affects of the project on listed marine turtles, will address dredging, blasting, and lighting concerns.

(11) Any incident involving the death or injury of listed species should be immediately reported to the Service (Vero Beach), NMFS (St. Petersburg office), and the Corps (Jacksonville District).

Corps response: The Corps concurs.

(12) Best Management Practices (BMPs) should be implemented to prevent excessive siltation during hopper barge loading (if such a vehicle is used). Proper maintenance of dredging equipment, the use of silt curtains or gunderbooms, performing operations when protected species are not present, and dredging only when environmental conditions are not contributory to siltation/sediment transport would minimize the impacts to fish and wildlife resources. It is recommended that certain protocols be followed, depending on the method used for dredging. If a hopper dredge is used, operators are recommended to eliminate or reduce hopper overflow, lower hopper fill-level, and use a recirculation system. If a mechanical dredge is used, operators should increase cycle time and eliminate both multiple bites and bottom stockpiling. For operations where a hydraulic dredge is used, cutterhead rotation speed and swing speed should be reduced, and bank undercutting should be eliminated. When applicable, special equipment, such as pneuma pumps, closed buckets, large capacity dredges, and precision dredging tools and technologies, are recommended to further decrease the potential for adverse effects to

marine communities (Corps 2001a).

Care should be taken during dredging efforts to limit the amount of fine sediment re-suspended to assure that impacts to adjacent seagrass beds and coral reefs would be minimized. If possible, turbidity containment devices should be installed.

Corps response: The Corps concurs.

(13) Due to the level of fine-grained material present in the benthic sediments of Biscayne Bay, this material should not be used for beach renourishment activities, instead it should be used as substrate at the seagrass restoration site.

Corps response: None of the material that will be dredged from the Miami Harbor Project will be placed on Miami Beaches.

(14) Biological monitoring should be conducted during a test blast in order to assess damage to populations of managed and protected fish species, and hence assess whether blasting impacts exceed acceptable levels. If results indicate that blasting has only minimal impacts on populations, and other Service recommendations are followed, blasting may be used where absolutely necessary. However, further monitoring would be required during project blasting. After each blast during project implementation, it is recommended that the effects of blasting on EFH and managed species, and species protected under the ESA or MMPA is determined. This plan should be coordinated and approved by Service and NMFS, and should ensure that no incidental take of manatees, sea turtles or sawfish occurs during construction (dredging, blasting, and hopper barge transport), and that harassment as defined by the MMPA is avoided. Use of hydrophones and other technologies to determine likely impacts is encouraged.

Corps response: The Corps does not expect any incidental take to occur as a result of our current blasting program.

(15) Continue bi-annual monitoring of mitigation areas for a minimum of 10 years to ensure acreage is maintained and remediate, if required.

Corps response: The Corps will adhere to the monitoring requirements of the DEP's Water Quality Certificate, when issued and accepted.

In addition, the Service strongly recommends inclusion of the following in the project design, to further minimize and reduce potential adverse effects of blasting on listed species, as excerpted from the FWC's Endangered Species Conservation Conditions for Blasting Activities dated June 2001.

(5) The FWC and Service must review a Blasting Proposal prior to any blasting activities. The blasting proposal must include information concerning a watch program and details

of the blasting events. This information must be submitted in writing at least 30 days prior to the proposed date of the blast(s) to the FWC, OES-BPS, 620 South Meridian Street, Tallahassee, Florida 32399-1600 and the Service's South Florida Ecological Services Office, 1339 20th Street, Vero Beach, Florida 32960. At a minimum, it should include the following information:

a) A list of observers, qualifications, and positions for the watch, including a map depicting the proposed locations for the boat or land-based observers.

b) The amount of explosive charge proposed, the explosive charge's equivalency in TNT, how it will be executed (depth of drilling, in-water, etc.), a drawing depicting the placement of the charges, size of the safety radius and how it will be marked (also depicted on a map), tide tables for the blasting event(s), and time tables (days and times) for blasting event(s).

(6) A formal watch coordination meeting at least 2 days prior to the first blast event. Attendants should include the designated observers, construction contractors, demolition subcontractors, and other interested parties such as the Service, FWC, and NMFS. All participants will be informed about the possible presence of manatees, dophins, marine turtles or whales in nearshore areas and that civil or criminal penalties can result from harassment, injury, and/or death of a listed species.

(7) The watch program should begin at least 1 hour prior to the scheduled start of blasting to identify the possible presence of manatees, dolphins, marine turtles or whales, if applicable. The watch program shall continue until at least one half-hour after detonations are complete.

(8) The watch program shall consist of a minimum of six observers. Each observer shall be equipped with a two-way radio that shall be dedicated exclusively to the watch program. Extra radios should be available in case of failures. All of the observers shall be in close communication with the blasting subcontractor in order to halt the blast event if the need arises. If all observers do no have working radios and cannot contact the primary observer and the blasting subcontractor during the pre-blast watch, the blast shall be postponed until all observers are in radio contact observers will be equipped with polarized sunglasses, binoculars, a red flag for backup visual communication, and a sighting log with a map to record sightings. All blasting events will be weather dependent. Climatic conditions must be suitable for optimal viewing conditions, determined by the observers.

(9) The watch program shall include a continuous aerial survey to be conducted by aircraft. The event shall be halted if an animal(s) is spotted within 300 feet of the perimeter of the safety zone or the danger zone as defined by the Corps in their project description. An "all-clear" signal must be obtained from the aerial observer before detonation can occur.

The blasting event shall be halted immediately upon request of any of the observers. If animals are sighted, the blast event shall not take place until the animal(s) move out of the area under their own volition. Animals shall not be herded away or harassed into leaving. Specifically, the animal must not be intentionally approached by project watercraft. If the animal(s) is not sighted a second time, the event may resume 30 minutes after the last sighting.

(10) The observers and contractors shall evaluate any problems encountered during blasting events and logistical solutions shall be presented to the Service and the FWC. Corrections to the watch shall be made prior to the next blasting event. If any one of the aforementioned conditions is not met prior to or during the blasting, the watch observers shall have the authority to terminate the blasting event until resolution can be reached with the Service and FWC.

(11) If an injured or dead marine mammal or turtle is sighted after the blast event, the watch observers shall contact the Service at 772-562-3909 and the FWC through the Manatee Hotline at 1-888-404-FWCC and 850-922-4330. The observers shall maintain contact with the injured or dead marine mammal or sea turtle until authorities arrive. Blasting shall be postponed until the Service and FWC can determine the cause of injury or mortality. If blasting injuries are documented, all demolition activities shall cease. A revised plan shall then be submitted to the Service and FWC for approval.

(12) Within 14 days after completion of all blasting events, the primary observer shall submit a report to the Service and FWC providing a description of the event, number and location of animals seen and what actions were taken when the animals were seen. Any problems associated with the events and suggestions for improvements shall also be documented in the report.

9.0 SUMMARY OF THE SERVICE'S POSITION

In conclusion, implementation of the Recommended Plan may impact fish and wildlife resources directly and indirectly as a result of dredging and/or blasting activities. The fish and wildlife resources likely to be directly and indirectly affected include: seagrasses, low-relief hardbottom, high-relief coral reefs, rock/rubble habitat, and shallow sandy bottom habitat. However, the Corps has proposed to avoid and minimize potential adverse effects through the redesign or exclusion of certain project elements and the implementation of listed species protection plans during construction activities.

In total, the Corps estimates that 6.3 acres of seagrass, 31.4 acres of low-relief hardbottom, 20.7 acres of high-relief coral reef, 123.5 acres of rock/rubble, and 236.4 acres of unconsolidated/ unvegetated benthic habitat will likely be adversely affected as a result of the expansion of Miami Harbor. However, many of these habitats occur in areas that were impacted during previous dredging activities within Miami Harbor. Therefore, the total impact of habitats not previously dredged and proposed for mitigation include: 6.3 acres of seagrass, 0.6 acre of low-relief hardbottom, 2.7 acres of high-relief coral reef.

As compensation for the effects of the action on previously non-dredged habitats, the Corps has proposed the following: (1) mitigate for the removal of 6.3 acres of seagrass at a ratio of 1:1 through the restoration of a 18.6-acre historic dredged borrow site in northern Biscayne Bay and bank the remaining acreage for potential seagrass impacts related to future Port dredge projects; (2) mitigate for the removal of 2.7 acres of high-relief coral reef habitat at a ratio of 2:1 through the creation of 5.4 acres of high-complexity, high-relief artificial reef habitat; and (3) mitigate for the 0.6 acre of impact to low-relief hardbottom habitat at a ratio of 1.3:1 through the creation of 0.8 acre of low-complexity, low-relief artificial hardbottom habitat. The Corps has not proposed compensation for the removal of the biotic communities that have colonized the channel walls since the last dredging event in 1991.

The Service has provided several recommendations in this document concerning blasting, monitoring, and mitigation to further minimize or avoid possible adverse effects of the action on fish and wildlife resources. Specifically, for the permanent removal hardbottom reef communities and seagrass habitat, as well as, the temporal loss of function of the invertebrate communities and habitat located within the existing channel, the following compensatory mitigation and monitoring are recommended: (1) restore 18.6 acres of seagrass habitat (2.9:1 ratio); (2) develop a Seagrass Monitoring Plan that contains success criteria that is consistent with Fonesca (1998); (3) provide additional mitigation for potential seagrass impacts within the proposed seagrass mitigation site; (4) create a 15.94 acre mitigation reef to compensate for the direct impact to all hardbottom habitat, as well as, the temporal loss of function of hardbottom habitat located within the previously dredged channels; (5) relocate existing stony coral greater than 6 inches in base diameter; and (6) recalculate mitigation acreage based on an increased time for recovery, if stony corals are not removed from the entrance channel and Fisher Island turning basin and relocated to a suitable area outside of the project area. In addition, the development of a comprehensive (pre, during, post project) environmental monitoring program is recommended to verify that project impacts occurred within the levels anticipated and to ensure that the mitigation areas are performing to level where habitat replacement values are maintained. The monitoring program should include damage assessments of the dredge anchoring and cable areas, as well as, include surveys of the hard coral relocation sites to determine transplant success.

The Service concurs with the Corps determination that the construction activities related to the modification of Miami Harbor to accommodate the expansion of the Port of Miami "may affect, but is not likely to adversely affect" the West Indian manatee and the American crocodile since appropriate monitoring to minimize these effects will be incorporated into the project design. In addition, the effects of the action will not result in the adverse modification to designated Critical Habitat for the West Indian manatee if sufficient mitigation is provided for seagrass impacts.

This final report is submitted in accordance with the FWCA and constitutes the final report of the Secretary of the Interior as required by Section 2(b) of the FWCA.

Literature Cited

American Ornithologists' Union (AOU). 1998. Check-list of North American Birds. 7^{th} Edition. American Ornithologists' Union, Washington, D.C. 829 pp.

Banks, K., R.E. Dodge, L. Fisher, D. Stout, and W. Jaap. 1998. Florida Coral Reef Damage from Nuclear Submarine Groundings and Proposed Restoration. Journal of Coastal Research. Special Issue 26, 64-71.

Blair, S., and B. Flynn. 1989. Biological Monitoring of Hardbottom Communities off Miami-Dade County Florida: Community Description. *In* Diving for Science 1989, Proceedings of the American Academy of Underwater Science, Ninth Annual Scientific Diving Symposium (Lang and Jaap, Editors). Costa Mesa, California.

Biscayne Bay Partnership Initiative (BBPI). 2001. Survey Team Final Reports. 320 pages.

Bohnsack, J.A., D. E. Harper, D.B. McClellan, M.W. Hulsbeck, T.N. Rutledge, M.H. Pickett, and A. Eklund. 1992. Quantitative Visual Assessment of Fish Community Structure in Biscayne National Park. NOAA NMFS-SEFSC. 45 pp.

Bohnsack, J.A., D.B. McClellan, D.E. Harper, G.S. Davenport, G.J. Konoval, A.M. Eklund, J. P . Contillo, S.K Bolden, P.C. Fishcel, G. S. Sandorf, J.C. Javech, M.W. White, M.H. Pickett, M.W. Hulsbeck, J.L Tobias, J.S. Ault, G..A. Meester, S.G. Smith, and J. A. Luo. 1999. Baseline data for evaluating reef fish populations in the Florida Keys, 1979-1998. NOAA Technical Memorandum NMFS-SEFSC-427. 61 pp.

Braun-Blanquet, J. 1965. Plant sociology: the study of plant communities. Hafner Publications, London. 439p.

Brown, G.L., W.L. Boyt, and M.A. Granat. 2001. Miami Harbor Channel Deepening Velocity and Salinity Assessment Phase I 2D Assessment. United States Army Corps of Engineers (Corps) Waterways Experiment Station.

Curtis and Kimball Company. 1999. Port of Miami Master Development Plan. 164 pages.

Deutsch, C.J. 2000. Winter movements and use of warm-water refugia by radio-tagged West Indian manatees along the Atlantic coast of the United States. Final Report prepared for the Florida Power and Light Company and U.S. Geological Survey. pp. 1-33.

Dial Cordy and Associates Inc. (DC&A). 2001. Environmental Baseline Study- Miami Harbor, General Reevaluation Report to United States Army Corps of Engineers, Jacksonville District, Jacksonville, FL. 58 pp.

Dial Cordy and Associates Inc. (DC&A). In Preparation. Miami Harbor GRR Study Mitigation Plan, DC&A, 2002. 16 pp.

Dodge, R.E., S. Hess, C. Messing. 1991. Final Report: Biological Monitoring of the John U. Lloyd Beach Renourishment: 1989. Prepared for Broward County Board of County Commissioners, Erosion Prevention District of the Office of Natural Resource Protection.

Environmental Protection Agency. 1995. Final Environmental Impact Statement for Designation of an Ocean Dredged Material Disposal site located offshore Miami, FL. 83 pages.

Florida Department of Environmental Protection. 1999. Air Monitoring Report

Florida Department of Environmental Protection. 2000. DEP Memorandum pertaining to Miami Harbor Channels Maintenance Dredging.

Florida Fish and Wildlife Conservation Commission (FWC). 1997. Florida's endangered species, threatened species and species of special concern official lists. Website: http://www.floridaconservation.org//pubs/endanger.html, accessed 21 December 2001.

Florida Marine Research Institute (FMRI). 2002a. Green Turtle Nesting Data for Southeast Florida. Website accessed 9 May 2002: http://floridamarine.org/features/view_article.asp?id=7630.

Florida Marine Research Institute (FMRI). 2002b. Leatherback Nesting Data for Southeast Florida. Website accessed 9 May 2002: http://floridamarine.org/features/view_article.asp?id=8225.

Florida Marine Research Institute (FMRI). 2002c. Loggerhead Nesting Data for Southeast Florida. Website accessed 9 May 2002: http://floridamarine.org/features/view_article.asp?id=8242.

Florida Power & Light Company. 1987. Florida Alligators and Crocodiles. 41 pp.

Flynn, B.S., S.M. Blair, and S.M. Markley. 1991. Environmental Monitoring of the Key Biscayne Beach Restoration Project. In: *Preserving and Enhancing Our Beach Environment.* Proceedings of the 1991 Beach Preservation Conference, Charleston, SC; Tallahassee, FL.

Fonseca, M.S., J.W. Kenworthy, and G.W. Thayer. 1998. Guidelines for the Conservation and Restoration of Seagrasses in the United States and Adjacent Waters. NOAA Coastal Ocean Program Decision Analysis Series, No. 12. NOAA Coastal Ocean Office, Silver Spring, MD.

Harlem, P.W. 1979. Aerial photographic interpretation of the historical changes in northern Biscayne Bay, Florida: 1925 to 1976. Sea Grant Technical Bulletin 40. University of Miami. Coral Gables, Florida.

Hartman, D.S. 1979. Ecology and behavior of the manatee (*Trichechus manatus*) in Florida. American Society of Mammalologists. Special Publication No. 5. 153 pp.

Hoffmeister, J.E., K.W. Stockman, and H.G. Multer. 1967. Miami Limestone of Florida and its Recent Bahamian Counterpart. Geological Society of America Bulletin. 78:175-190.

Iverson, E.S., and G. Beardsley. 1974. Impact of sand dredging on the fauna of a submerged bar south of Key Biscayne, Florida. Report to the Des Rocher Sand Co., Inc. (April 11, 1974).

Joint State/Federal Mitigation Bank Review Team (MBRT). 1998. Operational Draft. U.S. Army Corps of Engineers Jacksonville District. Jacksonville, Florida. pp. 5-8.

Jones, G.P., D.J. Ferrell, and P.F. Sale. 1991. Fish Predation and its Impacts on the Invertebrates of Coral Reefs and Adjacent Sediments. In *The Ecology of Fishes on Coral Reefs*. Academic Press Inc. 754pp.

Keevin, T.M. and G.L. Hempen. 1997. The Environmental Effects of Underwater Explosions with
Methods to Mitigate Impacts. U.S. Army Corps of Engineers; St. Louis District. https://www.denix.osd.mil/denix/Public/ES-Programs/Conservation/WaterX/water1.html#3

Konya, C. J. 2001. Recommendations for blasting at Port Everglades Harbor. Precision Blasting Services. Montville, Ohio. 45 pp.

Kurz, H. 1942. Florida dune and scrub vegetation. Geological Bulletin No. 23 of the Florida Geological Survey. 154 pp.

Marszalek, D.S. 1981. Impact of dredging on a subtropical reef community, southeast Florida, U.S.A. In: Proceedings of the 4th International Coral Reef Symposium, The Reef and Man. (Manila, Philippines, 1981). 1:147-153.

Mazzotti, F. J. (Personal Communication). 2000. University of Florida Everglades Research and Education Center.

Miami-Dade Department of Environmental Resources Management. 1999. Aerial sighting data for manatees for 1990-1999. Miami, Florida.

Miami-Dade Parks. 1999. Sea turtle nesting data for 1999. Miami Florida.

Miami-Dade County. 2000. Park & Recreation Department Sea Turtle Nesting Data 2000.

Moore, J.C. 1951. The Range of the Florida manatee. The Quarterly Journal of the Florida Academy of Sciences. Volume 14, No. 1. pp.18.

National Marine Fisheries Service (NMFS). 1998. Fisheries Service Lists Johnson's Seagrass as a Threatened Species. Press Release, Sept 14, 1998. St. Petersburg, Florida.

National Marine Fisheries Service (NMFS). 2000. Status review of smalltooth sawfish (Pristis pectinata). Web site accessed 2/1/02: http://www.nmfs.noaa.gov/prot_res/readingrm/statrvws/Smalltooth_sawfish.PDF

National Oceanic and Atmospheric Administration (NOAA). 1999. Magnitude and Extent of Chemical Contamination and Toxicity in Sediments of Biscayne Bay and Vicinity. Silver Spring, Maryland. 176 pp.

National Oceanic and Atmospheric Administration (NOAA). 2000a. Biscayne Bay: environmental history and annotated bibliography. Silver Spring, Maryland. 623 pp.

National Oceanic and Atmospheric Administration (NOAA). 2000b. Habitat Equivalency Analysis: An Overview. National Oceanic and Atmospheric Administration. Silver Spring, Maryland. 23 pp.

Odum, W.E., and C.C. McIvor. 1990. Mangroves. *In* Ecosystems of Florida. R.L. Myers and J.J. Ewel, editors. 765 pp.

Odum, W.E., McIvor, C.C., and T.J. Smith III. 1982. The ecology of the mangroves of south Florida; a community profile. Technical Report FWS/OBS 81-24. US Fish and Wildlife Service, Office of Biological Services.

O'Shea, T.J. 1988. The past, present, and future of manatees in the southeastern United States: Realities, misunderstandings, and enigmas. Pages 184-204 in R.R. Odum, K.A. Riddleberger, and J.C. Ozier, eds. Proceedings of the third southeastern nongame and endangered wildlife symposium. Georgia Department of Natural Resources, Game and Fish Division;
Atlanta, Georgia.

Seaman, W., Jr. Ed. 1985. Florida Aquatic Habitat and Fishery Resources. Florida Chapter of American Fisheries Society. 542 pp.

South Atlantic Fishery Management Council (SAFMC). 1998a. Final Comprehensive Amendment Addressing Essential Fish Habitat in Fishery Management Plans of the South

Atlantic Region. Charleston, SC. 142 pp.

South Atlantic Fishery Management Council (SAFMC). 1998b. Final Habitat Plan for the South Atlantic Region: Essential Fish Habitat Requirements for Fishery Management Plans of the South Atlantic Fishery Management Council. Charleston, SC. 408 pp.

Taylor, D.S., 1992. Mangrove Rivulus. *In:* C.R. Gilbert (ed.), Rare and Endangered Biota of Florida, Vol. II, Fishes. Gainesville, Florida. pp. 200-207.

United States Army Corps of Engineers (Corps). 1989. Navigation Study for Miami Harbor Channel, Florida. Feasibility Report and Environmental Impact Statement - 10140. 85 pages.

United States Army Corps of Engineers (Corps). 1996a. Coast of Florida Beach Erosion and Storm Effects Study, Region III, Feasibility Report with Final Environmental Impact Statement. Prepared by Gulf Engineers and Consultants, Inc.

United States Army Corps of Engineers (Corps). 1996b. Miami Harbor Channel, FL. 10140 General Reevaluation Report. 44 pages.

United States Army Corps of Engineers (Corps). 1997. National Harbors Program: Dredged Material Management Plans, Preliminary Assessment Miami Harbor, FL. 22 pages.

United States Army Corps of Engineers (Corps). 2000a. Analysis of Test Blast Results, Wilmington Harbor, NC (Appendix B). Preconstruction Modification of Authorized Improvements, Wilmington Harbor, NC. (February 2000). Wilmington District, Wilmington, North Carolina. 13 pp.

United States Army Corps of Engineers (Corps). 2000. Broward County, Florida Shore Protection Project General Reevaluation Report. Prepared by Coastal Planning and Engineering Inc./Olsen and Assoc. Inc.

United States Army Corps of Engineers. 2001a. Dredging "Best Management Practices" (derived from Hartman Consulting Group presentation, "How to Develop and Manage Successful Dredging Projects, 13-14 November, 1996). *In:* Long-Term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region, Management Plan 2001 (July 2001). U.S. Army Corps of Engineers San Francisco District. San Francisco, California.

United States Army Corps of Engineers (Corps). 2001. Miami Harbor General Re-evaluation Report, Miami Harbor Channel Deepening & Widening Geotechnical Investigation (October 2001). Jacksonville District US Army Corps of Engineers. Jacksonville, Florida. 7 pp.

United States Department of the Navy. 1998. Unidentified citation *In:* United States Army

Corps of Engineers (Corps). 2000a. Analysis of Test Blast Results, Wilmington Harbor, NC (Appendix B). Preconstruction Modification of Authorized Improvements, Wilmington Harbor, NC. (February 2000). Wilmington District, Wilmington, North Carolina. 13 pp.

United States Fish and Wildlife Service (USFWS). 1995.

United States Geologic Survey (Biological Resources Division). 2000. Sirenia Project, Florida Caribbean Science Center. Gainesville, FL.

Vare, Carman N. 1991. A survey, analysis, and evaluation of the nearshore reefs situated off Palm Beach County, Florida. Master's thesis. Florida Atlantic University. Boca Raton, Florida. 165 pp.

Virnstein, R.W., and L.J. Morris. 1996. Seagrass Preservation and Restoration: A Diagnostic Plan for the Indian River Lagoon. Tech. Mem. #14. St. Johns River Water Management District, Palatka, Florida. 43pp.

Young, G.A. 1991. Concise methods for predicting the effects of underwater explosions on marine life. NAVSWC MP 91-220. Research & Technology Department, Naval Surface Warfare Center.

Zieman, J.C. 1982. The Ecology of Seagrasses of South Florida: A Community Profile. United States Fish and Wildlife Services, Office of Biological Services, Washington, D.C. FWS/OBS-82/25. 158pp.

Personal Communications:

Grossenbacher, Craig. 2002 and 2003. Personal Communication (telephone/e-mails). County of Miami-Dade Department of Environmental Resources Management. Miami, Florida.

Zambrano, Ricardo. 2002. Personal Communication (telephone/e-mails). Florida Fish and Wildlife Conservation Commission. West Palm Beach, Florida.

APPENDIX A
History of the Miami Harbor Federal Project

MIAMI HARBOR, FLORIDA
Condition of Improvement, 30 September 1996

ACTS, WORK AUTHORIZED, and DOCUMENTS:

MIAMI RIVER
3 Jul 1930 Channel 15 feet deep by 90-150 feet wide Specified in Act.

MIAMI HARBOR
13 June 1902 Channel (Government Cut) 18 feet deep across peninsula and north jetty H. Doc.662/56/1 & A.R. for 1900 p.1987

2 March 1907 South Jetty and channel 100 feet wide. Specified in Act.

25 July 1912 Channel 20 feet deep by 300 feet wide and extension of Jetties H. Doc. 554/62/2

3 March 1925 Channel 25 feet deep at entrance and 25 feet deep by 200 feet across Biscayne Bay H. Doc. 516/67/4

3 July 1930 Channel 300 feet wide across Biscayne Bay and enlarging municipal turning basin. R. & H. Comm.
Doc. 15/71/2

30 August 1935 Depth of 30 feet to and in turning basin. S. Comm. Print 73.2

26 August 1937 Widen turning basin 200 feet on south side. R. & H. C.
Doc. 86/74/2

2 March 1945 Virginia Key improvement. (Deauthorized) S. Doc. 251/79/2

2 March 1945 Consolidation of Miami River and Miami Harbor projects; widening at mouth of Miami River (Deauthorized); a channel from the mouth of the river to the Intracoastal Waterway (Deauthorized); thence a channel from the Intracoastal Waterway to Government Cut(Deauthorized); and a channel from Miami River to harbor of refuse in Palmer Lake (Deauthorized). H. Doc. 91/79/1

14 July 1960 Channel 400 feet wide across Biscayne Bay; enlarge turning basin 300 feet on south and northeasterly sides; dredge turning basin on north side Fisher Island; deauthorize Virginia Key development. S. Doc. 71/85/2

13 August 1968 Enlarging the existing entrance channel to 38-foot depth and 500-foot width from the ocean to the existing beach line; deepening the existing 400-foot wide channel across Biscayne Bay to 36 feet; and deepening the existing turning basin at Biscayne Boulevard terminal and Fisher Island to 36 feet. S. Doc. 93/90/2

17 November 1986 Deauthorized the widening at the mouth of Miami River to existing project widths; and the channels from the mouth of Miami River to the turning basin, to Government Cut, and to a harbor of refuge in Palmer Lake. Public Law 99-662

28 November 1990 Deepening the existing Outer Bar Cut, Bar Cut, and Govt Cut to a depth of 44 ft.; Enlarging Fishermans Channel, south of Lummus Island, to a depth of 42 ft. and a width of 400 ft.; and Constructing a 1600 ft. diameter Turning Basin near the west end of Lummus Island to a depth of 42 ft. Public Law101-640
11/28/90

PROJECT: A channel 38 feet deep by 500 feet wide from the ocean to the existing beach line, thence 36 feet deep by 400 feet wide through the entrance and across Biscayne Bay and including a turning basin 16,500 feet wide and 1,700 feet long at the seaport terminals; two jetties at entrance; a turning basin along the north side of Fisher Island, about 39 acres in extent and 36 feet deep; a channel in Miami River 15 feet deep under flood conditions, 150 feet wide for 3 miles thence 125 feet wide for 1.1 miles, and thence 90 feet wide for 1.4 miles. Length of project is about 11.5 miles including 6.0 miles of channel from ocean to seaport terminals; and 5.5 miles in river, from its mouth westerly.

LOCAL COOPERATION: 204(e) Agreement between the U.S. Army Corps of Engineers and Port of Miami, Nov. 1991.

PROGRESS: Phase I of the project authorized by the 1990 Act is complete. Phase II was awarded for construction in September 1994 and is scheduled for completion in June 1998.

COST:

SPONSOR: Port of Miami
1015 North American Way
Miami, Florida 33132

Source:	http://www.saj.usace.army.mil/digitalproject/dpn/sajn_021.htm
Accessed:	8 May 2002
Date Page Created:	04/23/98
Date Page Last Updated:	10/17/01
Point of Contact:	Barry.D.Vorse@saj02.usace.army.mil

APPENDIX B
Habitat Equivalency Analyses

Table B-1: HEA effective acreage gained from recovery of low-relief hardbottom

Assumptions: dredging leaves 10% service, w/ linear increase

Year	% service level	% service loss	effective ac lost	discount factor	discount eff ac lost
2003	10.00%	90.00%	0.60	0.97	0.58
2004	17.50%	82.50%	0.50	0.94	0.47
2005	25.00%	75.00%	0.45	0.91	0.41
2006	32.50%	67.50%	0.41	0.88	0.36
2007	40.00%	60.00%	0.36	0.85	0.30
2008	47.50%	52.50%	0.32	0.82	0.26
2009	55.00%	45.00%	0.27	0.79	0.21
2010	62.50%	37.50%	0.23	0.76	0.17
2011	70.00%	30.00%	0.18	0.73	0.13
2012	77.50%	22.50%	0.14	0.70	0.09
2013	85.00%	15.00%	0.09	0.67	0.06
2014	92.50%	7.50%	0.05	0.64	0.03
2015	100.00%	0.00%	0.00	0.61	0.00
			total effective-acre years/ac:		3.07

Table B-2: HEA effective acreage gained from recovery of low-relief hardbottom

Assumptions: 20% service immediate, w/ linear increase

Year	% service level	% service increase	discount factor	discount eff ac gain
2003	20.00%	0.00%	1.00	0.00
2004	26.67%	6.67%	0.97	0.06
2005	33.33%	13.33%	0.94	0.13
2006	40.00%	20.00%	0.91	0.18
2007	46.67%	26.67%	0.88	0.23
2008	53.33%	33.33%	0.85	0.28
2009	60.00%	40.00%	0.82	0.33
2010	66.67%	46.67%	0.79	0.37
2011	73.33%	53.33%	0.76	0.41
2012	80.00%	60.00%	0.73	0.44
2013	86.67%	66.67%	0.70	0.47
2014	93.33%	73.33%	0.67	0.49
2015	100.00%	80.00%	0.64	0.51
		total effective-acre years/ac:		3.90

Table B-3: HEA acreage calculation for low-relief hardbottom compensation

impact area		0.6
present discounted interim losses		3.07
present discounted lifetime gains per acre of replacement project		3.9
R= # acres required for compensation		
3.07=3.9*R		
R=	3.07/3.9	
R=	0.787179	
	effective mitigation to compensation ratio:	1.316667

Table B-4: HEA effective acreage lost from impacts to high-relief reefs

Assumptions: dredging leaves 10% service, w/ linear increase

Year	% service level	% service loss	effective ac lost	discount factor	discount eff ac lost
2003	10.00%	90.00%	2.70	0.97	2.62
2004	13.00%	87.00%	2.35	0.94	2.21
2005	16.00%	84.00%	2.27	0.91	2.06
2006	19.00%	81.00%	2.19	0.88	1.92
2007	22.00%	78.00%	2.11	0.85	1.78
2008	25.00%	75.00%	2.03	0.82	1.65
2009	28.00%	72.00%	1.94	0.79	1.53
2010	31.00%	69.00%	1.86	0.76	1.41
2011	34.00%	66.00%	1.78	0.73	1.29
2012	37.00%	63.00%	1.70	0.70	1.19
2013	40.00%	60.00%	1.62	0.67	1.08
2014	43.00%	57.00%	1.54	0.64	0.98
2015	46.00%	54.00%	1.46	0.61	0.88
2016	49.00%	51.00%	1.38	0.58	0.79
2017	52.00%	48.00%	1.30	0.55	0.71
2018	55.00%	45.00%	1.22	0.52	0.63
2019	58.00%	42.00%	1.13	0.49	0.55
2020	61.00%	39.00%	1.05	0.46	0.48
2021	64.00%	36.00%	0.97	0.43	0.41
2022	67.00%	33.00%	0.89	0.40	0.35
2023	70.00%	30.00%	0.81	0.37	0.30
2024	73.00%	27.00%	0.73	0.34	0.25
2025	76.00%	24.00%	0.65	0.31	0.20
2026	79.00%	21.00%	0.57	0.28	0.16
2027	82.00%	18.00%	0.49	0.25	0.12
2028	85.00%	15.00%	0.40	0.22	0.09
2029	88.00%	12.00%	0.32	0.19	0.06
2030	91.00%	9.00%	0.24	0.16	0.04
2031	94.00%	6.00%	0.16	0.13	0.02
2032	97.00%	3.00%	0.08	0.10	0.01
2033	100.00%	0.00%	0.00	0.07	0.00
			total effective-acre years/ac:		25.76

Table B-5: HEA effective acreage gained from recovery of high-relief reefs

Assumptions: 20% service immediate, w/ linear increase

Year	% service level	% service increase	discount factor	discount eff ac gain
2003	20.00%	0.00%	1.00	0.00
2004	22.67%	2.67%	0.97	0.03
2005	25.33%	5.33%	0.94	0.05
2006	28.00%	8.00%	0.91	0.07
2007	30.67%	10.67%	0.88	0.09
2008	33.33%	13.33%	0.85	0.11
2009	36.00%	16.00%	0.82	0.13
2010	38.67%	18.67%	0.79	0.15
2011	41.33%	21.33%	0.76	0.16
2012	44.00%	24.00%	0.73	0.18
2013	46.67%	26.67%	0.70	0.19
2014	49.33%	29.33%	0.67	0.20
2015	52.00%	32.00%	0.64	0.20
2016	54.67%	34.67%	0.61	0.21
2017	57.33%	37.33%	0.58	0.22
2018	60.00%	40.00%	0.55	0.22
2019	62.67%	42.67%	0.52	0.22
2020	65.33%	45.33%	0.49	0.22
2021	68.00%	48.00%	0.46	0.22
2022	70.67%	50.67%	0.43	0.22
2023	73.33%	53.33%	0.40	0.21
2024	76.00%	56.00%	0.37	0.21
2025	78.67%	58.67%	0.34	0.20
2026	81.33%	61.33%	0.31	0.19
2027	84.00%	64.00%	0.28	0.18
2028	86.67%	66.67%	0.25	0.17
2029	89.33%	69.33%	0.22	0.15
2030	92.00%	72.00%	0.19	0.14
2031	94.67%	74.67%	0.16	0.12
2032	97.33%	77.33%	0.13	0.10
2033	100.00%	80.00%	0.10	0.08
			total effective-acre years/ac:	4.84

Table B-6: HEA acreage calculation for high-relief compensation

injured area	2.7
present discounted interim losses	25.76
present discounted lifetime gains per acre of replacement project	4.84
R= # acres required for compensation	
25.76=4.84*R	
R= 25.76/4.84	
R= 5.322314	
effective mitigation to compensation ratio:	1.971227

APPENDIX C
Calculation of Compensation for Temporal Loss of Habitat

Table C-1: MBRT acreage calculations for compensation for adverse effects to previously impacted hardbottom habitat, including channel walls.

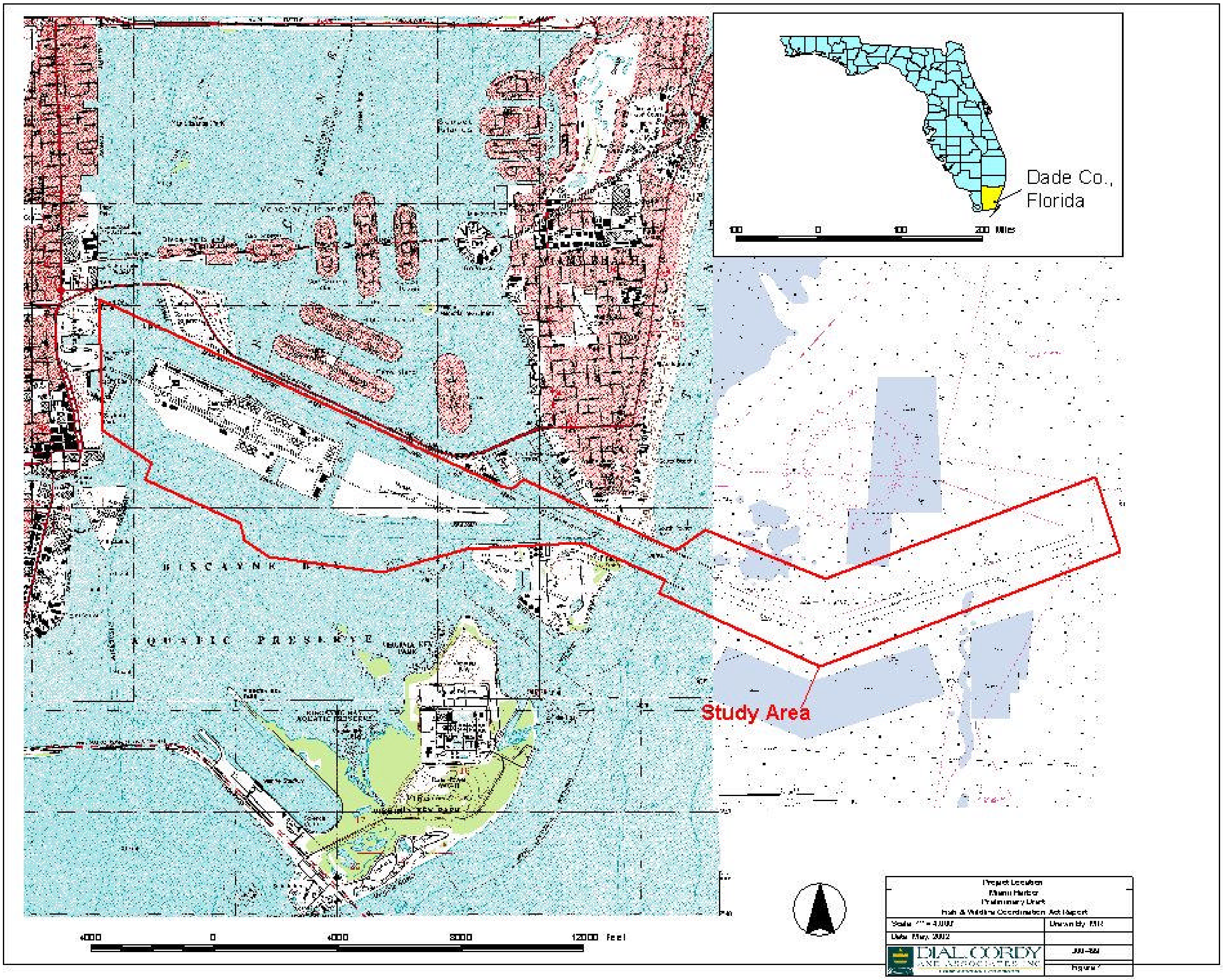
Previously Dredged Hardbottom (Component 1: Low-and High-Relief Hardbottom)

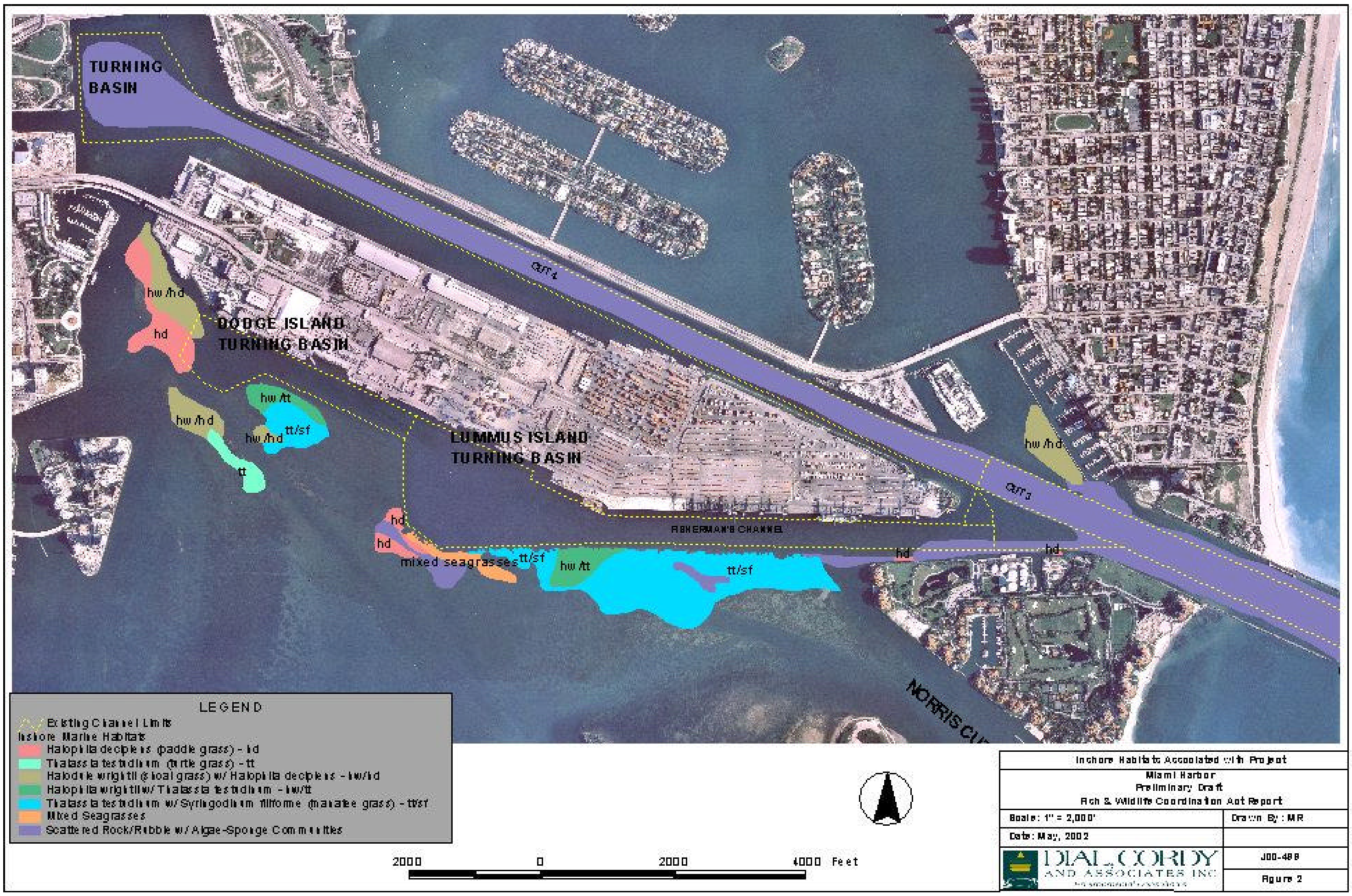
Δ TA = F	where:
Δ =	change in the capacity of an individual habitat function for a given polygon (0.90)
T =	temporal lag factor correction to account for temporal losses of habitat function (0.8339 from table)
A =	area for impacts, or unknown mitigation area
F =	functional units
48.7	= A = impacts to habitats requiring **12** years for recovery, i.e., channel bottom habitat, not including previous mitigation acreage. (from GIS analyses)
0.9x48.7=	functional units in impact area
43.83	= F = functional units in impact area
0.9x.8333(A)=43.83	compensation equation
A= <u>43.83</u> 0.75 A= 58.44	area required for mitigation of temporal loss of habitat, previously impacted high- and low-relief hardbottom habitat , including channel walls.

Channel Wall (Component 1: Low-relief hardbottom within the areas proposed for widening)

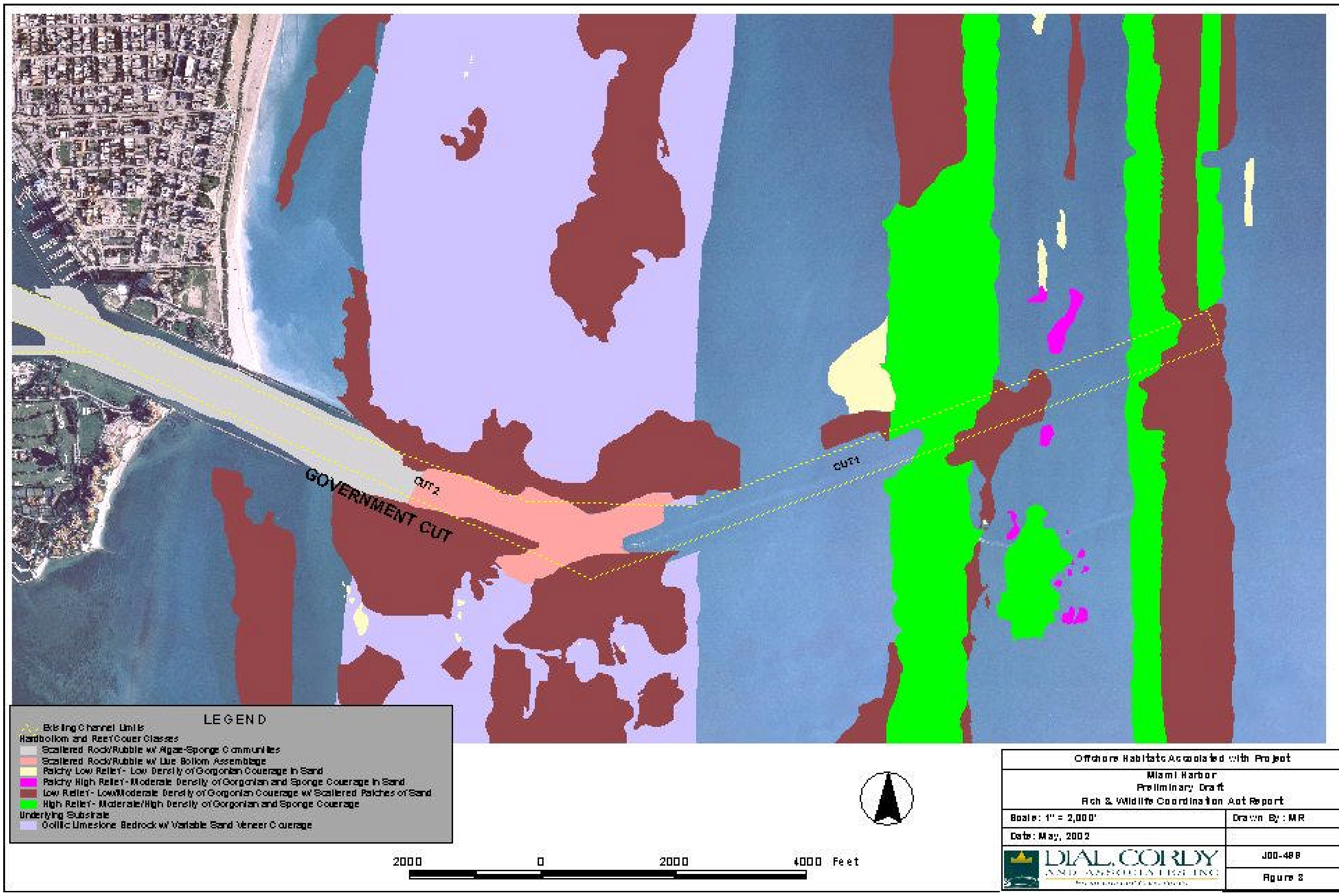
Δ TA = F	where:
Δ =	change in the capacity of an individual habitat function for a given polygon (0.90)
T =	temporal lag factor correction to account for temporal losses of habitat function (0.9507from table)
A =	area for impacts, or unknown mitigation area
F =	functional units
2.67	= A = impacts to habitats requiring **4** years for recovery, i.e., channel wall habitat (from GIS analyses)
0.9x2.67=	functional units in impact area
2.403	= F = functional units in impact area
0.9x.9507(A)=2.40	compensation equation
2.8 = A	area required for mitigation of temporal loss of habitat, previously impacted substrates in area proposed for widening

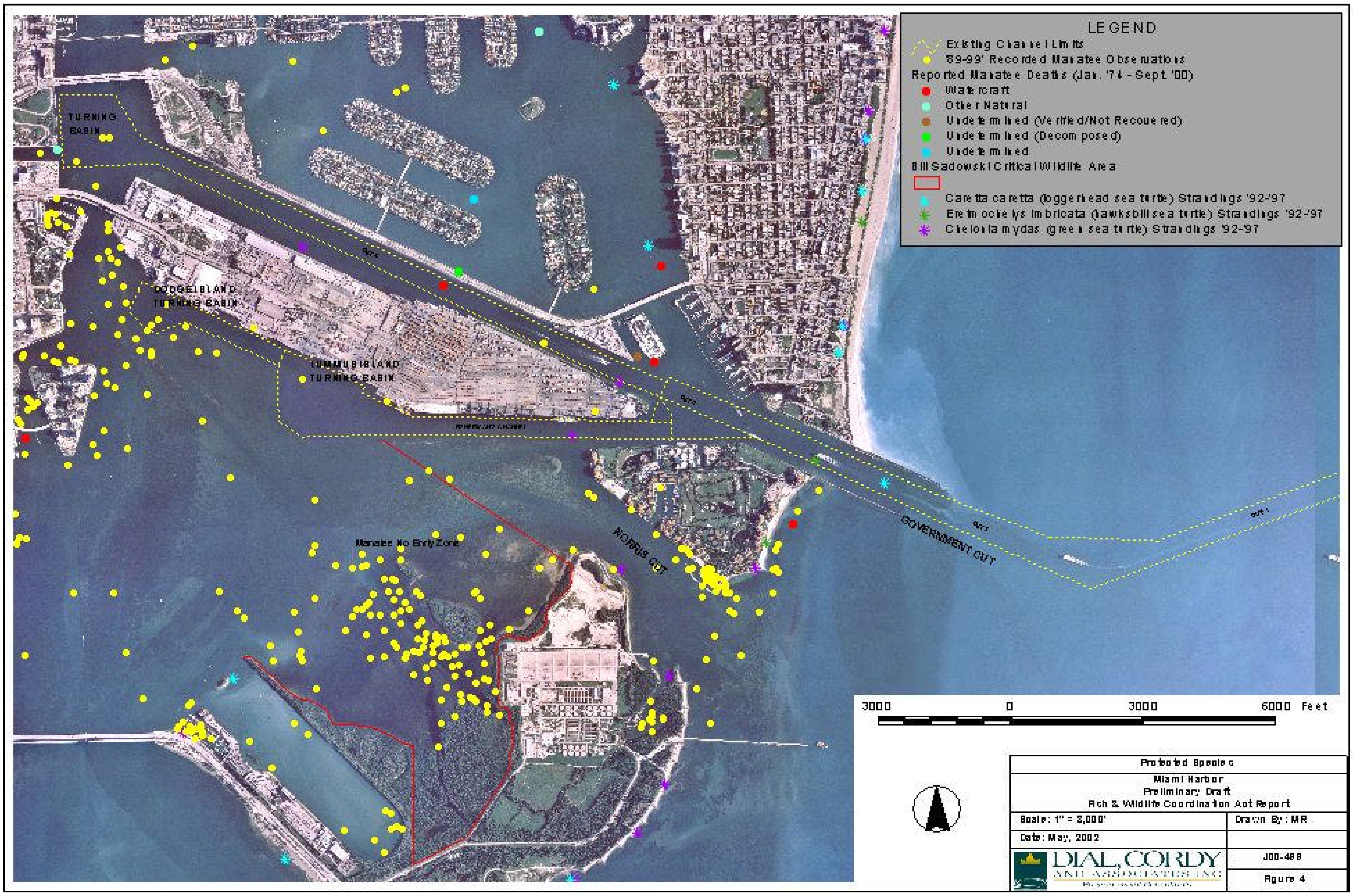
APPENDIX D: Figures


Dade Co., Florida
100
0
100
200 Miles
BISCAYNE BAY
AQUATIC PRESERVE
Study Area
4000
0
4000
8000
12000 Feet
Project Location
Miami Harbor
Preliminary Draft
Fish & Wildlife Coordination Act Report
Date May 2002
DIAL CORDY AND ASSOCIATES INC

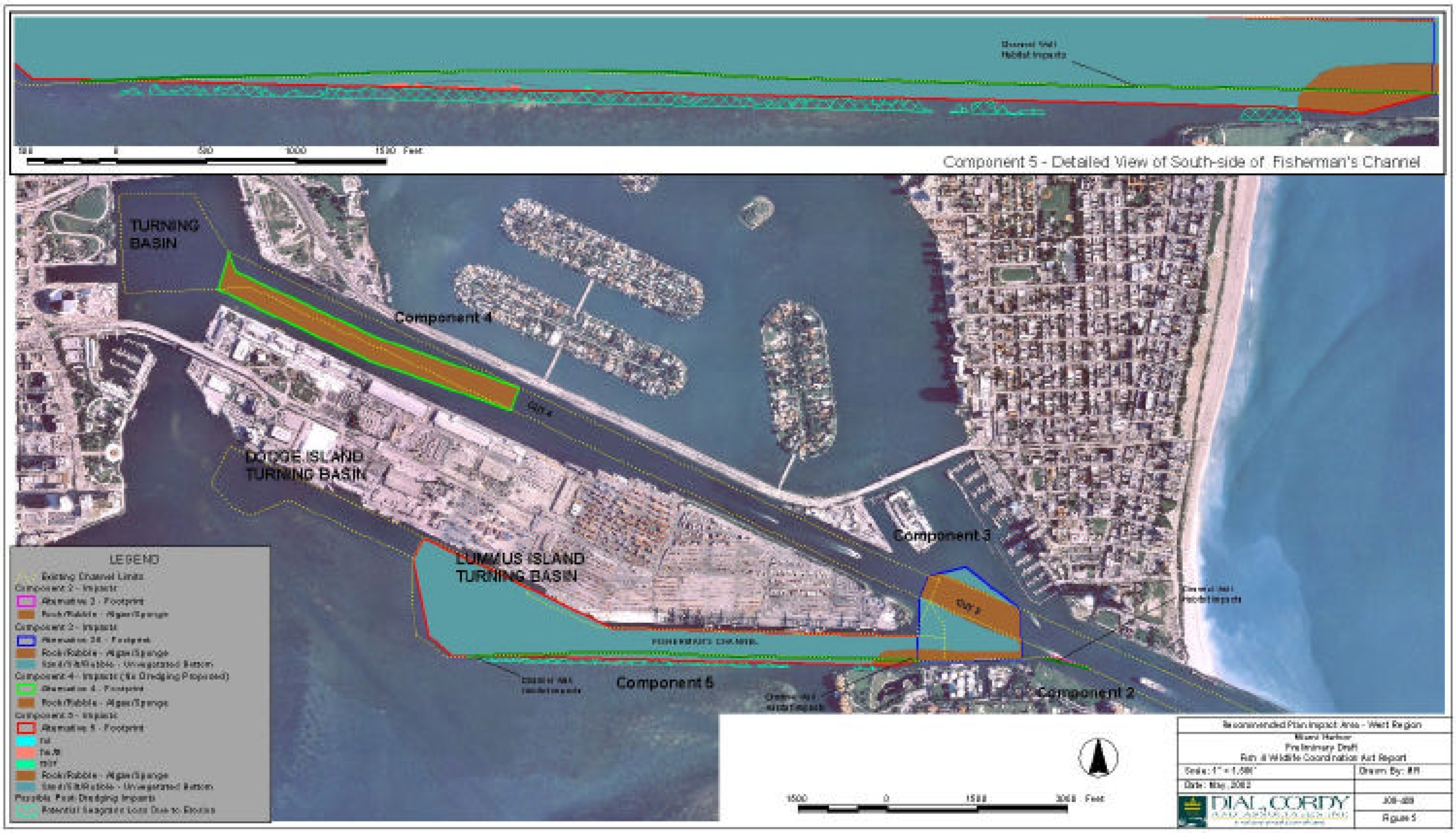


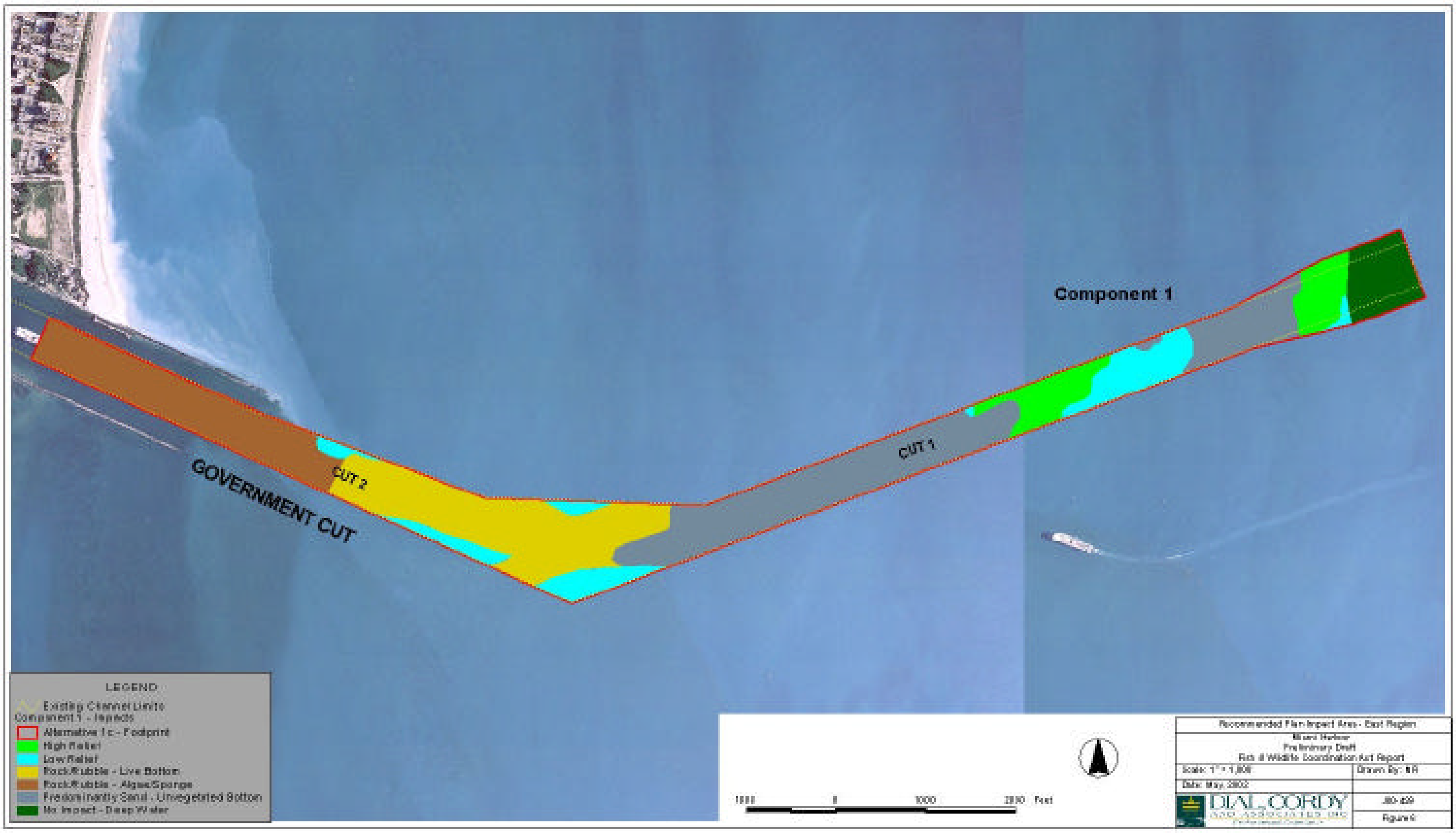
TURNING BASIN
CUT 4
DODGE ISLAND TURNING BASIN
LUMMUS ISLAND TURNING BASIN
FISHERMAN'S CHANNEL
CUT 3
NORRIS CUT
hw/hd
hd
hw/tt
tt/sf
tt
mixed seagrasses
LEGEND
Existing Channel Limits
Inshore Marine Habitats
Halophila decipiens (paddle grass) - hd
Thalassia testudinum (turtle grass) - tt
Halodule wrightii (shoal grass) w/ Halophila decipiens - hw/hd
Halophila wrightii w/ Thalassia testudinum - hw/tt
Thalassia testudinum w/ Syringodium filiforme (manatee grass) - tt/sf
Mixed Seagrasses
Scattered Rock/Rubble w/ Algae-Sponge Communities
2000 0 2000 4000 Feet
Inshore Habitats Associated with Project
Miami Harbor
Preliminary Draft
Fish & Wildlife Coordination Act Report
Scale: 1" = 2,000'
Drawn By: MR
Date: May, 2002
DIAL CORDY AND ASSOCIATES INC
J00-488
Figure 2

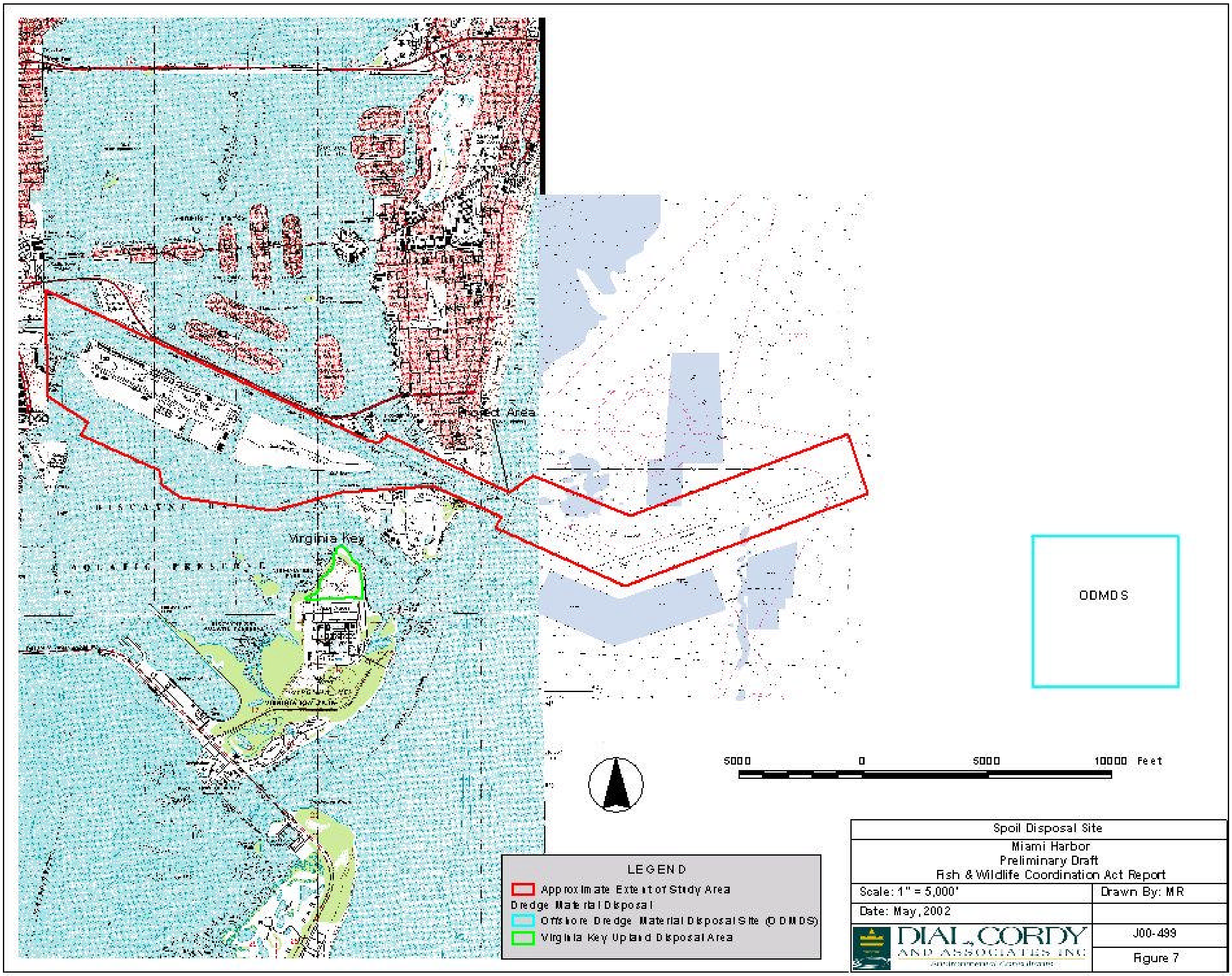

GOVERNMENT CUT
CUT 2
CUT 1
LEGEND
Existing Channel Limits
Hardbottom and Reef Cover Classes
Scattered Rock/Rubble w/ Algae-Sponge Communities
Scattered Rock/Rubble w/ Live Bottom Assemblage
Patchy Low Relief - Low Density of Gorgonian Coverage in Sand
Patchy High Relief - Moderate Density of Gorgonian and Sponge Coverage in Sand
Low Relief - Low/Moderate Density of Gorgonian Coverage w/ Scattered Patches of Sand
High Relief - Moderate/High Density of Gorgonian and Sponge Coverage
Underlying Substrate
Oolitic Limestone Bedrock w/ Variable Sand Veneer Coverage
2000 0 2000 4000 Feet
Offshore Habitats Associated with Project
Miami Harbor
Preliminary Draft
Fish & Wildlife Coordination Act Report
Scale: 1" = 2,000'
Drawn By: MR
Date: May, 2002
DIAL CORDY AND ASSOCIATES INC
J00-488
Figure 3

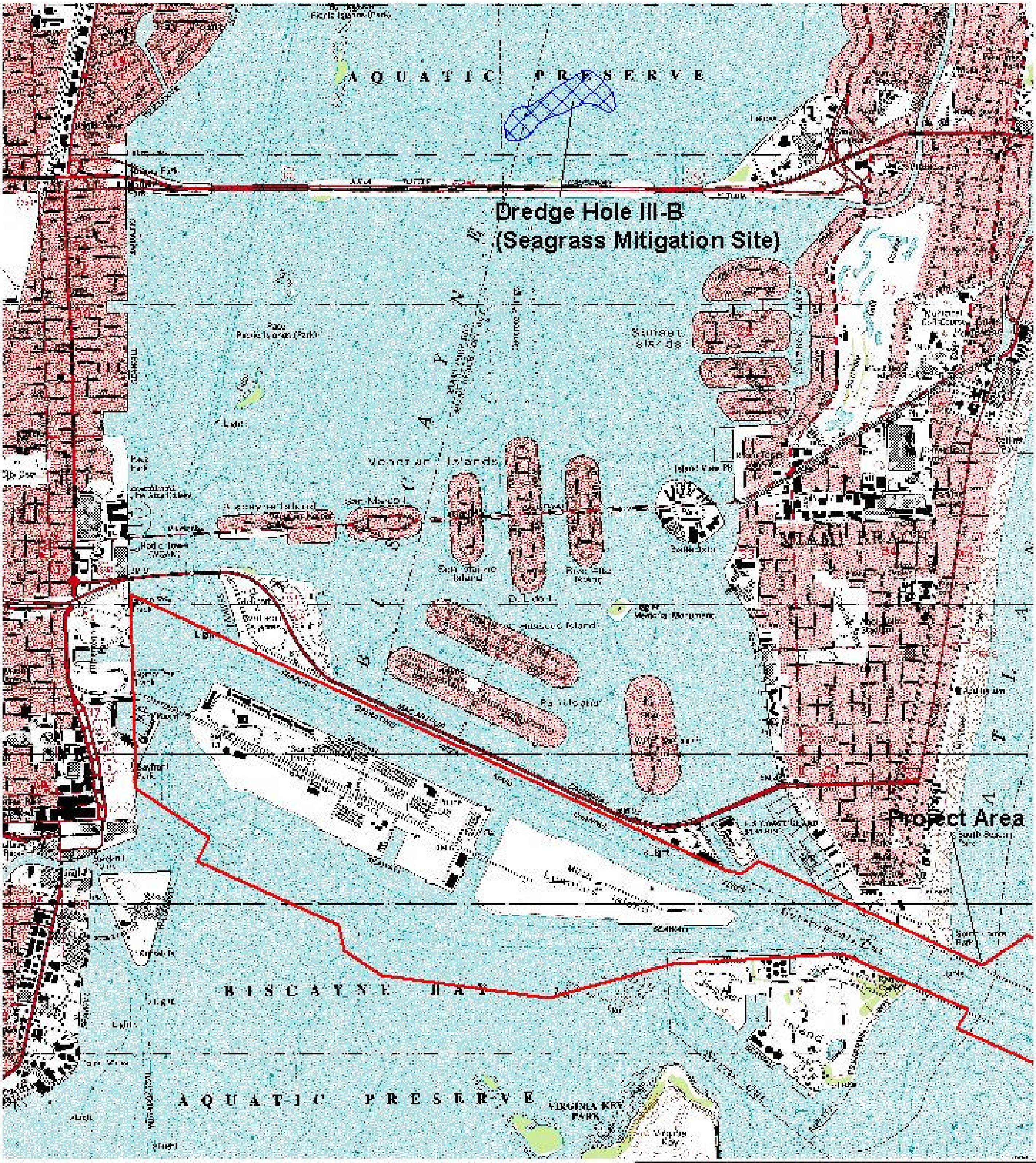


TURNING BASIN
DODGE ISLAND TURNING BASIN
LUMMUS ISLAND TURNING BASIN
Manatee No Entry Zone
NORRIS CUT
GOVERNMENT CUT
LEGEND
Existing Channel Limits
'89-99' Recorded Manatee Observations
Reported Manatee Deaths (Jan. '74 - Sept. '00)
Watercraft
Other Natural
Undetermined (Verified/Not Recovered)
Undetermined (Decomposed)
Undetermined
Bill Sadowski Critical Wildlife Area
Caretta caretta (loggerhead sea turtle) Strandings '92-'97
Eretmochelys imbricata (hawksbill sea turtle) Strandings '92-'97
Chelonia mydas (green sea turtle) Strandings '92-'97
3000
0
3000
6000 Feet
Protected Species
Miami Harbor
Preliminary Draft
Fish & Wildlife Coordination Act Report
Scale: 1" = 3,000'
Drawn By: MR
Date: May, 2002
DIAL, CORDY AND ASSOCIATES INC.
J00-488
Figure 4

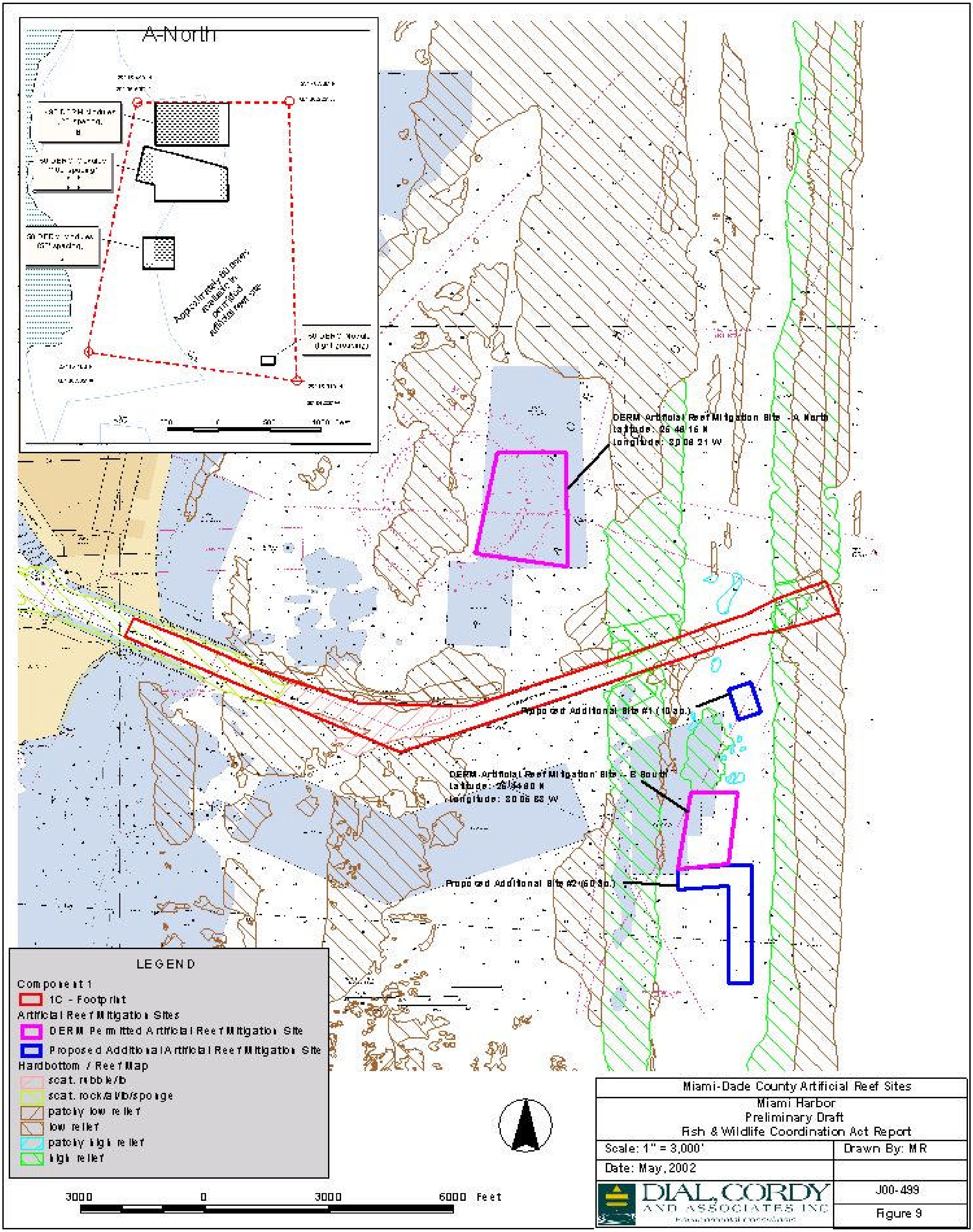

Component 5 - Detailed View of South-side of Fisherman's Channel
TURNING BASIN
Component 4
DODGE ISLAND TURNING BASIN
LUMMUS ISLAND TURNING BASIN
Component 3
Component 5
Component 2
FISHERMAN'S CHANNEL
LEGEND
Existing Channel Limits
Component 2 - Impacts
Alternative 2 - Footprint
Rock/Rubble - Algae/Sponge
Component 3 - Impacts
Rock/Rubble - Algae/Sponge
Sand/Silt/Rubble - Unvegetated Bottom
Component 4 - Impacts (No Dredging Proposed)
Alternative 4 - Footprint
Rock/Rubble - Algae/Sponge
Component 5 - Impacts
Alternative 5 - Footprint
Rock/Rubble - Algae/Sponge
Sand/Silt/Rubble - Unvegetated Bottom
Possible Post-Dredging Impacts
Potential Seagrass Loss Due to Erosion
Recommended Plan Impact Area - West Region
Miami Harbor
Preliminary Draft
Fish & Wildlife Coordination Act Report
Date: May, 2003
Figure 5


Component 1
CUT 1
CUT 2
GOVERNMENT CUT
LEGEND
Existing Channel Limits
Component 1 - Impacts
Alternative 1c - Footprint
High Relief
Low Relief
Rock/Rubble - Live Bottom
Rock/Rubble - Algae/Sponge
Predominantly Sand - Unvegetated Bottom
No Impact - Deep Water
1000 0 1000 2000 Feet
Recommended Plan Impact Area - East Region
Miami Harbor
Preliminary Draft
Fish & Wildlife Coordination Act Report
Scale: 1" = 1,800
Drawn By: NR
Date: May 2002
DIAL CORDY AND ASSOCIATES INC
Figure 6


Project Area
Virginia Key
ODMDS
5000 0 5000 10000 Feet
LEGEND
Approximate Extent of Study Area
Dredge Material Disposal
Offshore Dredge Material Disposal Site (ODMDS)
Virginia Key Upland Disposal Area
Spoil Disposal Site
Miami Harbor
Preliminary Draft
Fish & Wildlife Coordination Act Report
Scale: 1" = 5,000'
Drawn By: MR
Date: May, 2002
DIAL, CORDY AND ASSOCIATES INC
J00-499
Figure 7

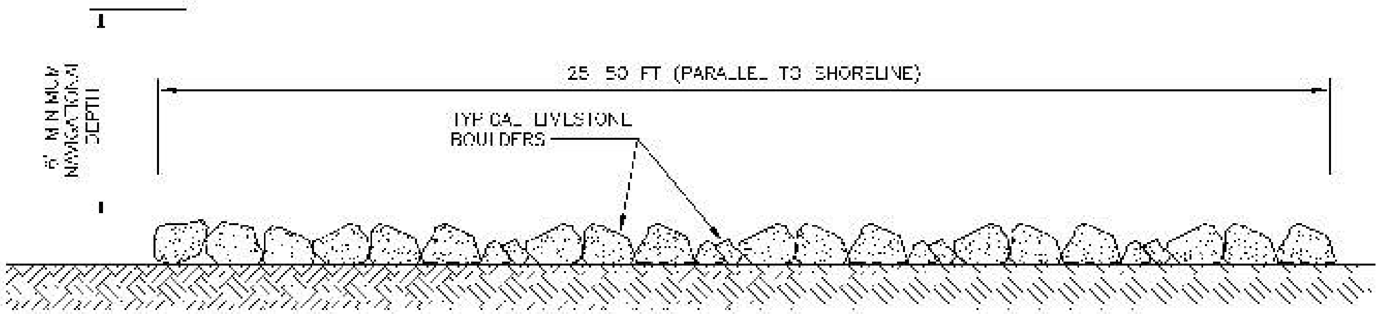


Seagrass Compensation Site	
Miami Harbor Preliminary Draft Fish & Wildlife Coordination Act Report	
Scale: 1" = 3,000'	Drawn By: MR
Date: May, 2002	
DIAL, CORDY AND ASSOCIATES INC. Environmental Consultants	J00-499
	Figure 8

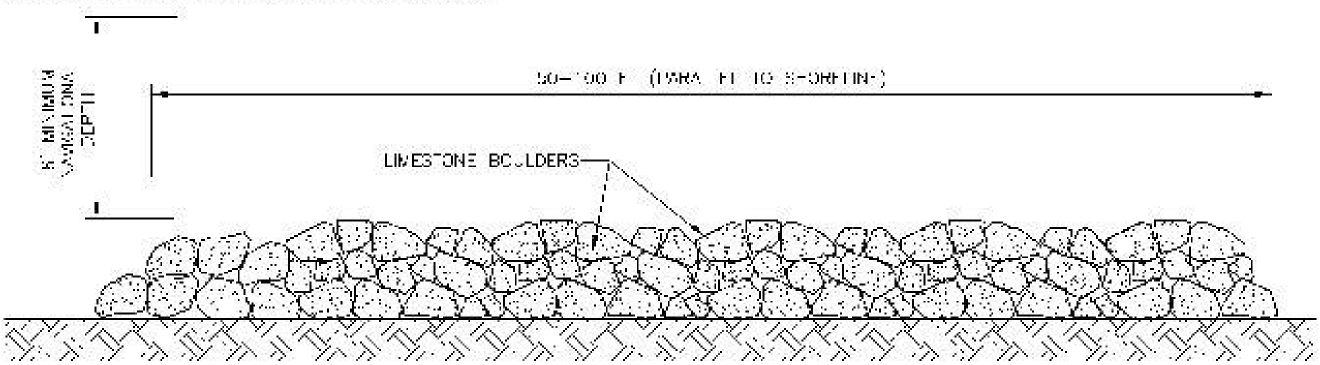


Miami-Dade County Artificial Reef Sites	
Miami Harbor Preliminary Draft Fish & Wildlife Coordination Act Report	
Scale: 1" = 3,000'	Drawn By: MR
Date: May, 2002	
DIAL, CORDY AND ASSOCIATES INC.	J00-499
	Figure 9

Low-Relief, Low Complexity Artificial Reef Design



High-Relief, High Complexity Artificial Reef Design



Conceptual Design for Artificial Reefs Miami Harbor Preliminary Draft Fish & Wildlife Coordination Act Report	
Scale: NTS	Drawn By: MR
Date: May, 2002	
DIAL, CORDY AND ASSOCIATES INC	J00-499
	Figure 10

APPENDIX E: Tables

Table 1: Relative Abundance of Fish Species Observed During Visual Survey

Common Name	Scientific Name	South Transects	North Transects
Bar Jack	Caranx ruber	A	--
Beaugregory	Pomacentrus partitus	A	A
Bluehead Wrasse	Thalassoma bifasciatum	A	C
Bluestripe Grunt	Haemulon sciurus	-	C
Cocoa Damselfish	Pomacentrus variabilis	A	A
Foureye Butterflyfish	Chaetodon capistratus	C	C
French Angelfish	Pomacanthus paru	O	O
Gray Snapper	Lutjanus griseus	O	C
Grey Angelfish	Pomacanthus arcuatus	O	-O
Hogfish	Lachnolaimus maximus	O	O
Ocean surgeon	Acanthurus bahianus	-	C
Pearly Razorfish	Hemipteronotus novacula	-	O
Pigfish	Orthoprisits chysoptera	C	C
Porkfish	Anisotremus virginicus	C	C
Princess parrotfish	Scarus guacamaia	O	O
Rainbow parrotfish	Scarus guacamaia	O	O
Redlip Blenny	Opioblennius atlanticus	O	O
Reef Butterflyfish	Chaetodon sedentarius	C	C
Rock Beauty	Holocanthus tricolor	-	C
Seaweed Blenny	Parablennius marmoreus	O	O
Slippery Dick	Halichores bivittatus	C	C
Spanish Hogfish	Bodianus rufus	-	R
Spotted Scorpionfish	Scorpaena plumieri	O	O
Stoplight parrotfish	Sparisoma viride	O	O
Tomtate	Haemulon aurolineatum	C	C
Townsend Angelfish	Holocanthus sp.	R	-
Yellowtail Snapper	Ocyurus chysurus	C	C

KEY: A = abundant, C = common, O = occasional, R = rare

Source: Dial Cordy and Associates, 2001

Table 2: Summary of Sea Turtle Nesting for Miami-Dade County, 1988-2001

Loggerhead (Caretta caretta)[1]

Year	Beach Length (km)	Number of Nests	Number of Non-Nesting Emergences	Date of First Nest	Date of Last Nest
1988	29.9	219	196	05/02/88	08/27/88
1989	29.9	325	407	04/17/89	08/12/89
1990	31.5	390	486	04/07/90	08/22/90
1991	30.7	439	510	04/25/91	08/28/91
1992	38.6	367	416	04/23/92	09/15/92
1993	38.9	392	401	04/28/93	10/03/93
1994	34.7	445	454	04/22/94	08/30/94
1995	37.4	470	595	04/29/95	08/27/95
1996	37.6	448	517	04/26/96	08/20/96
1997	38.1	415	599	04/23/97	08/14/97
1998	38.1	545	937	04/18/98	08/26/98
1999	37.8	516	565	04/10/99	08/18/99
2000	37.8	516	775	04/12/00	09/20/00
2001	37.8	496	564	04/19/01	08/21/01

Green turtles (Chelonia mydas)[2]

Year	Beach Length (km)	Number of Nests	Number of Non-Nesting Emergences	Date of First Nest	Date of Last Nest
1988	29.9	6	2	06/13/88	07/08/88
1989	29.9	2	6	07/01/89	07/07/89
1990	31.5	3	2	05/16/90	07/01/90
1991	30.7	2	2	07/17/91	07/26/91
1992	38.6	4	5	06/27/92	08/03/92
1993	38.9	1	0	06/20/93	06/20/93
1994	34.7	1	1	06/02/94	06/02/94
1995	37.4	2	0	05/21/95	06/27/95
1996	37.6	12	13	06/17/96	08/19/96
1997	38.1	0	2	-	-
1998	38.1	4	10	05/31/98	07/28/98
1999	37.8	64	78	04/23/99	08/18/99
2000	37.8	5	7	06/20/00	07/28/00
2001	37.8	0	0	-	-

Leatherbacks (Dermochelys coriacea)[3]

Year	Beach Length (km)	Number of Nests	Number of Non-Nesting Emergences	Date of First Nest	Date of Last Nest
1988	29.9	5	0	04/25/88	05/14/88
1989	29.9	0	0	-	-
1990	31.5	0	0	-	-
1991	30.7	0	0	-	-
1992	38.6	6	3	04/11/92	05/29/92
1993	38.9	1	0	05/09/93	05/09/93
1994	34.7	0	0	-	-
1995	37.4	2	2	05/15/95	05/25/95
1996	37.6	0	0	-	-
1997	38.1	3	3	04/30/97	05/19/97
1998	38.1	2	1	03/30/98	05/16/98
1999	37.8	9	5	03/29/99	06/09/99
2000	37.8	2	5	03/05/00	03/20/00
2001	37.8	9	7	03/28/01	05/24/01

[1]source: Florida Marine Research Institute. 2002c.
[2]source: Florida Marine Research Institute. 2002a.
[3]source: Florida Marine Research Institute. 2002b.

Table 3 Current Channel and Turning Basin Dimensions

Component 1 – Entrance Channel (Cut-1) & Government Cut (Cut-2)	500 feet wide, 44-foot depth
Component 2 - Cut-3 at Fisherman's Channel	500 feet wide, 42-foot depth
Component 3 – Fisher Island Turning Basin	1200-foot-diameter turning basin, 42-foot depth
Component 4 – Main Channel (Cut-4)	400 feet wide, 36-foot depth
Component 5 – Fisherman's Channel and Lummus Island Turning Basin	400 feet wide, 42-foot depth; turning basin with 42-foot depth and diameter of 1,600 feet
Component 6 – Dodge Island Cut and Turning Basin	400 feet wide with 34 and 32-foot depths (existing turning basin not part of federal project)

Table 4 Components of the Alternatives

Component 1	Flaring the existing 500-foot wide entrance channel to provide an 800-foot wide entrance channel at Buoy 1. The widener extends from the beginning of the entrance channel about 150 feet parallel to both sides of the existing entrance channel for about 900 feet before tapering back to the existing channel edge over a total distance of about 2000 feet. Deepening of the entrance channel and proposed widener along Cut 1 and Cut 2 from an existing depth of 44 feet in one-foot increments to a depth of 52 feet received consideration.
Component 2	Widen the southern intersection of Cut-3 with Lummus Island (Fisherman's) Channel at Buoy 15. The length of the widener is about 700 feet with a maximum width of about 75 feet. Depths considered for 2A varied from an existing project depth of 42 feet to 50 feet.
Component 3	Extend the existing Fisher Island turning basin to the north. A turning notch of about 1500 feet by 1200 feet extends approximately 300 feet to the north of the existing channel edge near the West End of Cut-3. Depths from 43 to 50 feet at one-foot increments below the existing depth of 42 feet received consideration in the area of the turning notch.
Component 4	Relocate the west end of the main channel (cruise ship channel or Cut-4) about 250 feet to the south between channel miles 2 and 3 to the existing cruise ship turning basin. No dredging is expected for measure four since existing depths allow for continuation of the authorized depth of 36 feet.
Component 5	Increase the width of the Lummus Island Cut (Fisherman's Channel) about 100 feet to the south of the existing channel. Measure 5 includes a 1500-foot diameter turning basin, which would reduce the existing size of the Lummus Island (or Middle) turning basin. The deepening evaluation examined depths below the existing 42-foot depth at one-foot increments from 43 to 50 feet along the proposed widened channel from Cut-3, Station 0+00 to Cut-3, Station 42+00.
Component 6	Deepen Dodge Island Cut and the proposed 1200-foot turning basin from 32 and 34 feet to 36 feet. It also involves relocating the western end of the Dodge Island Cut to accommodate proposed port expansion.

Components of the Recommended Plan are listed in boldface.

Table 5: Impact Acreages by Habitat Type and Current Dredge Status

Habitat Type and Current Dredge Status	Component no.					
	1	2	3	4	5	Total
Seagrass- new impacts to areas not previously dredged and that exist *outside proposed channel boundaries* (ac)	00.0	00.0	00.1	00.0	**6.0**	**6.1**
Seagrass- new impacts, not previously dredged, inside proposed channel boundaries (ac)	00.0	00.0	00.0	00.0	**0.2**	**0.2**
Seagrass- previously dredged and recolonized, inside proposed channel boundaries (ac)	00.0	00.0	00.0	00.0	00.0	00.0
Low-relief hardbottom- new impacts, not previously dredged (ac)	**0.6**	00.0	00.0	00.0	00.0	**0.6**
Low-relief hardbottom, previously dredged and recolonized (ac)	**28.1**	**0.26**	00.0	00.0	**2.41**	**30.7**
High-relief hardbottom- new impacts, not previously dredged (ac)	**2.7**	00.0	00.0	00.0	00.0	**2.7**
High-relief hardbottom, previously dredged and recolonized (ac)	**18.0**	00.0	00.0	00.0	00.0	**18.0**
Rock/rubble w/ livebottom- new impacts, not previously dredged (ac)	00.0	00.0	00.0	00.0	00.0	00.0
Rock/rubble w/ livebottom, previously dredged and recolonized (ac)	**51.7**	00.0	00.0	00.0	00.0	**51.7**
Rock/rubble w/ algae/sponges- new impacts, not previously dredged (ac)	00.0	**0.6**	**0.9**	00.0	**1.5**	**3.0**
Rock/rubble w/ algae/sponges, previously dredged and recolonized (ac)	**41.3**	00.0	**25.2**	00.0	**2.3**	**68.8**
Unvegetated (i.e., softbottom habitats without seagrasses)- new impacts, not previously dredged (ac)[1]	**1.3**	00.0	**5.3**	00.0	**16.7**	**23.3**
Unvegetated (i.e., softbottom habitats without seagrasses), previously dredged (ac)	**66.9**	00.0	**19.1**	00.0	**127.1**	**213.1**
Total Impacts, including impacts to seagrass beds that exist outside proposed channel boundaries (ac)	**210.6**	**0.86**	**50.6**	**00.0**	**156.2**	**418.2**

[1]not including secondary impacts acting over time, such as side-slope erosion

Table 6 Essential Fish Habitats Associated with Recommended Plan

Plan Component	Essential Fish Habitats Impacted
1	Water Column, Hardbottom, Reefs, possible *Laurencia* beds
2	Water Column, possible *Laurencia* beds
3	Water Column, Inshore Softbottom
4	None
5	Water Column, Inshore Softbottom, Seagrass Beds